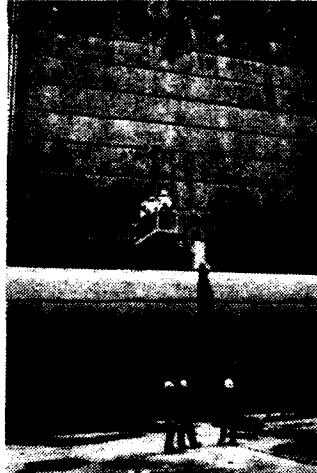
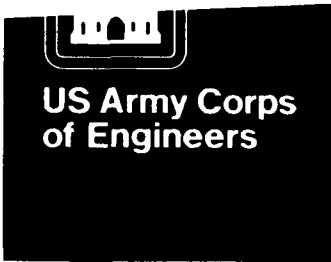


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REPAIR, EVALUATION, MAINTENANCE, AND
REHABILITATION RESEARCH PROGRAM

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TECHNICAL REPORT REMR-OM-12

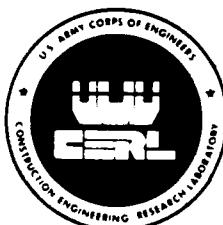
REMR MANAGEMENT SYSTEMS--USER'S MANUAL FOR
OBTAINING A CONDITION INDEX OF A CONCRETE
NAVIGATION LOCK

by

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University of Illinois
Urbana, Illinois 61801

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March 1992
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Washington, DC 20314-1000
Under Civil Works Research Work Unit 32880

The following two letters used as part of the number designating technical reports of research published under the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program identify the problem area under which the report was prepared:

<u>Problem Area</u>		<u>Problem Area</u>	
CS	Concrete and Steel Structures	EM	Electrical and Mechanical
GT	Geotechnical	EI	Environmental Impacts
HY	Hydraulics	OM	Operations Management
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COVER PHOTOS:

TOP - Inspectors look at a vertical crack outside the John Day Lock chamber, Columbia River.

BOTTOM - Inspectors view a vertical crack in the dewatered John Day Lock, Columbia River.

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13. ABSTRACT (Maximum 200 words) The U.S. Army Corps of Engineers operates approximately 270 navigation lock chambers constructed of plain or reinforced concrete. Many of these structures require, or will require significant repairs to ensure safe and efficient operations. Modern engineering technology is providing procedures for performing condition surveys, consistent and quantitative conditions assessment, and data base management. Combined with economic analyses, these procedures afford efficient maintenance and repair (M&R) budget planning through the evaluation of current condition and the comparison of various M&R alternatives based on life cycle costs. Collectively these procedures are called the Repair, Evaluation, Maintenance and Rehabilitation (REMR) Management System. The LOCKWALL program documented in this manual addresses the REMR aspects of concrete navigation lock monoliths.				
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Preface

The program documented herein was authorized by Headquarters, US Army Corps of Engineers (HQUSACE), as part of the Operations Management problem area of the Repair, Evaluation, Maintenance, and Rehabilitation (REMR) Research Program. The work was performed under Civil Works Research Unit 32880, "Development of Uniform Evaluation Procedures and Condition Index for Deteriorated Structures and Equipment," for which Dr. Anthony M. Kao is Principal Investigator. Mr. James E. Crews (CECW-O) is the REMR Technical Monitor for this study.

Mr. Jesse A. Pfeiffer, Jr. (CERD-C) is the REMR Coordinator at the Directorate of Research and Development, HQUSACE. Mr. Crews and Dr. Tony Liu (CECW-EG) serve as the REMR Overview Committee. Mr. William F. McCleese (CEWES-SC-A), US Army Engineer Waterways Experiment Station (WES), is the REMR Program Manager. Dr. Kao is the Problem Area Leader for the Operations Management problem area.

This work was performed by the Automation Support Center, University of Illinois under the general supervision of Dr. Paul A. Howdyshell, Chief, Engineering and Materials Division (EM) of the US Army Construction Engineering Research Laboratory (USACERL) and the direct supervision of David McKay (USACERL-EM). The technical editor was Gloria J. Wienke, USACERL Information Management Office.

Programming was done by K.J. Stephenson, J.M. Elston, S.M. Morton, J. Allen, M.P. Hanley, T. Chen, N. Mickenbecker, P.J. Wallace, and P. Kohler of the Automation Support Center. Documentation was written by K.J. Stephenson, D. Brinegar, M.B. Bailey, D. Cornell, P.J. Wallace, W.A. Nelson, C.S. Olson, and S.M. Morton of the Automation Support Center.

COL Daniel Waldo, Jr. is Commander and Director of USACERL, and Dr. L.R. Shaffer is Technical Director.

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Background

REMR Management Systems

The U.S. Army Corps of Engineers operates approximately 270 navigation lock chambers constructed of plain or reinforced concrete. Many of these structures require, or will require, significant repairs to ensure safe and efficient operations. The Repair, Evaluation, Maintenance and Rehabilitation (REMR) Research Program was conducted to identify and develop effective and affordable technology for maintaining and extending the service life of existing Corps Civil Works structures.

Modern engineering technology is providing procedures for performing condition surveys, consistent and quantitative condition assessment, and data base management. Combined with economic analyses, these procedures afford efficient maintenance and repair (M&R) budget planning through the evaluation of current condition and the comparison of various M&R alternatives based on life cycle costs. Collectively these procedures are called the REMR Management System.¹ By using the REMR Management System, many of the subjective elements in the decisionmaking process are removed from M&R planning. Components of the system address the REMR aspects of the miter gate² and steel sheet pile³ elements of lock structures. The LOCKWALL program documented in this manual addresses the REMR aspects of concrete navigation lock monoliths.

Navigation Locks

A quantitative rating system for the condition of concrete in navigation lock monoliths has been developed and is described in Technical Report REMR-OM-4.⁴ This rating system provides a quantitative means for comparing the condition of concrete in one monolith to that in another. The computer application of this system, LOCKWALL, is described in Technical Report REMR-OM-10.⁵ LOCKWALL is a support tool for managers who plan REMR activities for concrete navigation lock chambers.

¹Yu, H. Thomas and Kao, Anthony M. 1988 (Sept). "REMR Management System," Technical Report REMR-OM-2, US Army Construction Engineering Research Laboratory, Champaign, Ill.

²Greimann, Lowell, Stecker, James, and Rens, Kevin. 1990 (Aug). "Inspection and Rating of Miter Lock Gates," Technical Report REMR-OM-7, US Army Construction Engineering Research Laboratory, Champaign, Ill; Greimann, Lowell, Stecker, James, and Rens, Kevin. 1990 (Dec). "REMR Management Systems-Navigation Structures Management System for Miter Lock Gates," Technical Report REMR-OM-08, US Army Construction Engineering Research Laboratory, Champaign, Ill.

³Greimann, Lowell and Stecker, James. 1989 (June). "User's Manual: Inspection and Rating of Steel Sheet Pile Structures," Technical Report REMR-OM-3, US Army Construction Engineering Research Laboratory, Champaign, Ill; Greimann, Lowell and Stecker, James. 1990 (Dec). "Maintenance and Repair of Steel Sheet Pile Structures," Technical Report REMR-OM-09, US Army Construction Engineering Research Laboratory, Champaign, Ill.

⁴Bullock, R.E. 1989 (May). "A Rating System for the Concrete in Navigation Lock Monoliths," Technical Report REMR-OM-4, US Army Engineer Waterways Experiment Station, Vicksburg, Miss.

⁵McKay, David T. and Kao, Anthony M. 1990 (Sept.) "LOCKWALL: A Microcomputer-based Maintenance and Repair Management System for Concrete Navigation Lock Monoliths," Technical Report REMR-OM-10, US Army Construction Engineering Research Laboratory, Champaign, Ill.

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Chapter 1

Introduction

CONCRETE LOCKWALL MAINTENANCE MANAGEMENT MODULE OVERVIEW

LOCKWALL is a microcomputer-based application. As in most data-base-oriented programs, LOCKWALL performs data base administration, calculations, and generates reports. The following fundamental pieces of LOCKWALL are briefly described: Inventory, Condition Assessment, Maintenance and Repair Alternatives, and Life Cycle Costs.

I. Inventory

The LOCKWALL program houses an inventory of all waterway systems and navigation lock structures contained within any given Division. Data pertinent to each structure, such as owner/operator, construction date, lock width, lock length, lock lift, etc. are stored. This static data is in place when LOCKWALL is delivered.

The first-time condition inspection data is entered for a given structure; LOCKWALL prompts the user to characterize each lockwall and guidewall by providing lists of the monolith identification numbers that comprise each wall. The monolith ID numbers are taken from engineering drawings. This one-time process ensures that monolith identification numbers used by different inspection teams remain consistent.

II. Condition Assessment

The condition inspection data is gathered by visual observation and performing simple measurements. The inspection catalogs the location and extent of concrete cracking, loss of volume, and deterioration. Other forms of distress such as exposed steel, leaks, stains, deposits, and missing or damaged armor are noted. The data is accepted and stored by LOCKWALL which uses an algorithm to produce a Condition Index (CI) for each monolith inspected. The CI is a numeric representation of the condition of the concrete in each monolith. The CI ranges from 0 to 100 with 100 reflecting an "as built" condition. A CI of 40 indicates a "Poor" condition. The CI algorithm is designed to produce Condition Indices that reflect those conditions shown in Figure 1. Engineering and management actions associated with the CI are described in the same figure. Great care is taken in the development of the algorithm and inspection procedure to ensure that the results are consistent and repeatable. It is such uniformity that allows an objective comparison of the condition of concrete in one structure to that of another.

Zone	Condition Index	Condition Description	Recommended Action
1	85 to 100	<u>Excellent</u> : No noticeable defects. Some aging or wear may be visible.	Immediate action is not required.
	70 to 84	<u>Very Good</u> : Only minor deterioration or defects are evident.	
2	55 to 69	<u>Good</u> : Some deterioration or defects are evident, but function is not significantly affected.	Economic analysis of repair alternatives is recommended to determine appropriate action.
	40 to 54	<u>Fair</u> : Moderate deterioration. Function is still adequate.	
3	25 to 39	<u>Poor</u> : Serious deterioration in at least some portions of the structure. Function is inadequate.	Detailed evaluation is required to determine the need for repair, rehabilitation, or reconstruction. Safety evaluation is recommended.
	10 to 24	<u>Very Poor</u> : Extensive deterioration. Barely functional.	
	0 to 9	<u>Failed</u> : No longer functions. General failure or complete failure of a major structural component.	

Figure 1. Condition Index Scale

III. Maintenance and Repair Alternatives

A wealth of information regarding maintenance and repair operations for concrete lockwalls has been gathered and stored in the LOCKWALL program. Most of the information is taken directly from Engineering and Design - Evaluation and Repair of Concrete Structures (Engineer Manual [EM] 1110-2-2002, Headquarters, US Army Corps of Engineers, Washington, D.C., 1986). The information exists in the form of American Standard Code for Information Interchange (ASCII) files. These ASCII files can be sent to the PC monitor for viewing or to the printer for hard copy. These files do not interact with the CI data base in any way. They are in place strictly for informational purposes. The files serve as a library to help you research and determine proper maintenance strategies for a given set of distresses.

IV. Life Cycle Costs

The LOCKWALL program has a Life Cycle Cost Analysis (LCCA) utility that can be directly tied into the CI inspection data base. In terms of LCCA maintenance planning, all LCCAs require a standard input: inflation rate, interest rate, required life of overall maintenance, beginning year of maintenance plan, individual maintenance activity description, cost of individual maintenance activity, expected life of individual maintenance activity, and beginning year of individual maintenance activity. The standard output is a financial schedule showing the required real-time dollars and present worth of such dollars to implement each individual maintenance activity. Total cost and total present worth for the overall plan are presented.

USING THIS MANUAL

The following conventions are used throughout the manual:

- Most entries must be followed by a carriage return [**RETURN**].
- Examples will be given when applicable.

USING THE LOCKWALL MAINTENANCE MANAGEMENT MODULE

The following conventions are used with the Lockwall Module:

- The box at the bottom of the screen is the key information box. Available keys and their function are noted in that box.
- Some data fields may be optional, however, most must be completed for the condition index calculation to be valid. Incomplete data sets may be saved as suspect data. Suspect data will **not** be used in the calculation process. In the event of saving an incomplete data set, a warning screen will pop up to notify you that this set is considered suspect data and which fields are missing.
- The **F10 Done** key may be used at any time during program operation.

During data entry and modification, the **F10** key will prompt you to **Save the data and return**, **Abort the data and return**, or **Continue editing the current data set**. Upon completion of the save and abort, the system returns you to the previous screen.

At non-data entry and modification screens, the **F10** key simply returns you to the previous screen.

- A carriage return [**RETURN**] is not required if an input field is filled with the maximum number of characters. The cursor will automatically advance to the next input field.
- The Lockwall Module is menu driven. There are two types of menus in the system. In either type of menu, an option may be selected by:
 1. Using the arrow keys to highlight the desired option and press [**RETURN**].
 2. Press the key designated as the **trigger**.

In menu type 1, the trigger keys are **A**, **B** and **C**. Each trigger is highlighted and enclosed in square brackets.

MENU TYPE 1

- [**A**] Option 1
- [**B**] Option 2
- [**C**] Option 3

In menu type 2, the triggers are **M**, **S**, and **2**. Each trigger is highlighted and embedded in the choice text.

MENU TYPE 2

- Main Menu
- Submenu 1
- Submenu 2

- Data entry is handled in two ways:
 1. Data entry type 1 uses a **Popup Menu** system. The appropriate data may be selected by the two methods described above.
 2. Data entry type 2 requires you to directly key in the information. The size of the data field is dictated by the size of the box following the prompt.

Chapter 2

Using the Concrete Lockwall Maintenance Management Module

This chapter will explain the steps required before entering data into the Lockwall Module. The following topics will be covered:

- Hardware Requirements
- Setting Up the Proper Configuration
- Installing the Lockwall Module
- Accessing the Program
- Explanation of Keys (Help, Function, Scrolling)

HARDWARE REQUIREMENTS

The Lockwall Condition Index Module was developed for operation on an IBM (™ International Business Machines Corp.)-compatible personal computer that runs MS-DOS (™ Microsoft Corp.) version 3.0 or higher. A hard disk drive is required with a recommended 20 megabytes or higher storage capacity. 640K RAM memory is also required.

If the computer has memory-resident utilities, such as Sidekick or PC Tools, loaded into memory, they **must** be unloaded before the Lockwall Module can be run.

If the Lockwall Maintenance Management Module is to be run on a slow PC, a system for disk caching is highly recommended. Many available utilities, shareware and otherwise, can improve disk performance substantially.

SETTING UP THE PROPER CONFIGURATION

A file called CONFIG.SYS must be present in the root directory of the PC with the following commands for the Lockwall Module to run properly.

**BUFFERS = 25
FILES = 25**

The CONFIG.SYS file can be detected by typing **DIR CONFIG.SYS** in the root directory. If the file exists, the PC will list the file name, size, and date created. If you do not have a

CONFIG.SYS file, use a text editor (not a word processor unless the information can be saved in text format) to create one with the above commands. Place the file in the root directory of the PC. After creating a new CONFIG.SYS, reboot the PC (CTRL-.ALT-DEL). To ensure that the PC has at least 640K of available RAM memory, type the command **CHKDSK** to receive a disk and memory status report. The last two lines displayed on the screen are those to check. They should read:

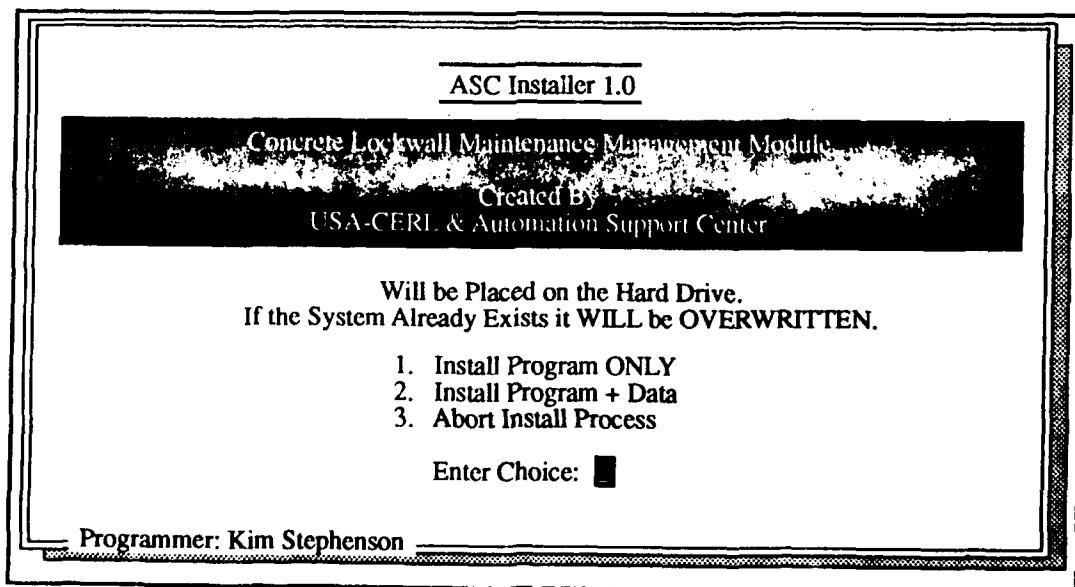
```
# BYTES TOTAL MEMORY  
# BYTES FREE
```

The number of bytes total memory should be 640K or greater. The number of bytes free should be 570K or greater. If it is not, check for the presence of a memory-resident utility. For further explanation concerning CONFIG.SYS, BUFFERS, and FILES commands, consult a DOS manual.

INSTALLING THE LOCKWALL MAINTENANCE MANAGEMENT MODULE

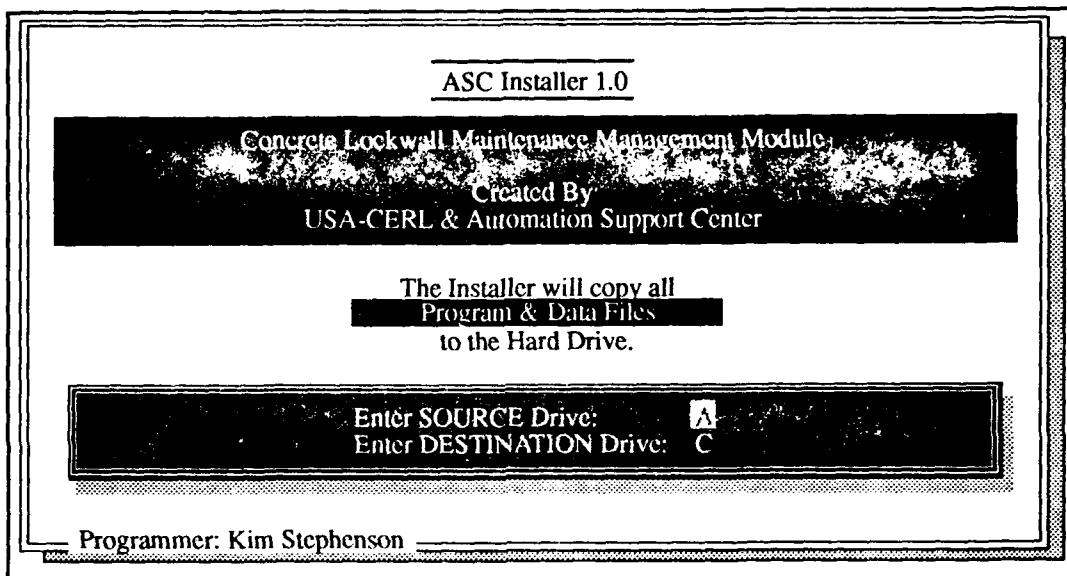
The Lockwall Module is distributed in three different formats: three 360k 5.25 in. diskettes, one 1.2 Mb 5.25 in. diskette, or one 1.44 Mb 3.5 in. diskette. All the files will be copied onto the local hard drive when the program is installed. A summary of the install procedure follows:

1. Insert the floppy disk labeled **Disk #1** into the PC's **A:** drive.
2. Type **A:**
3. Begin the install process. Type **INSTALL**
4. The following screen will be displayed.

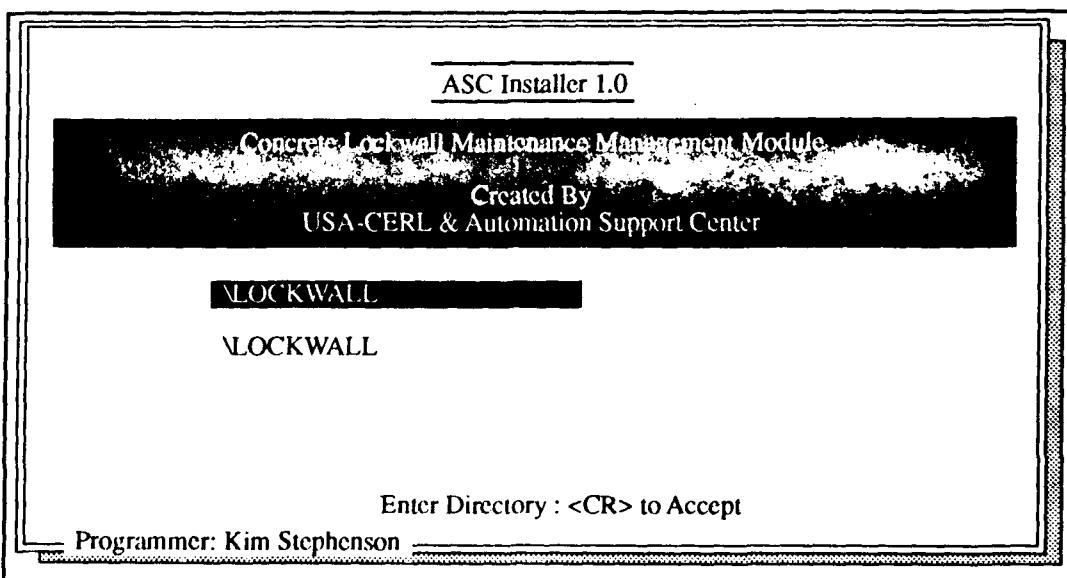


The installer displays a menu allowing you to either install the program or the program and the data. If the Concrete Lockwall Maintenance Management Module already exists on the computer it will be OVERWRITTEN by the install. Selecting option one, INSTALL PROGRAM ONLY, will install only program files leaving the data files intact. Selecting option two, INSTALL PROGRAM + DATA, will overwrite both the program and the existing data files.

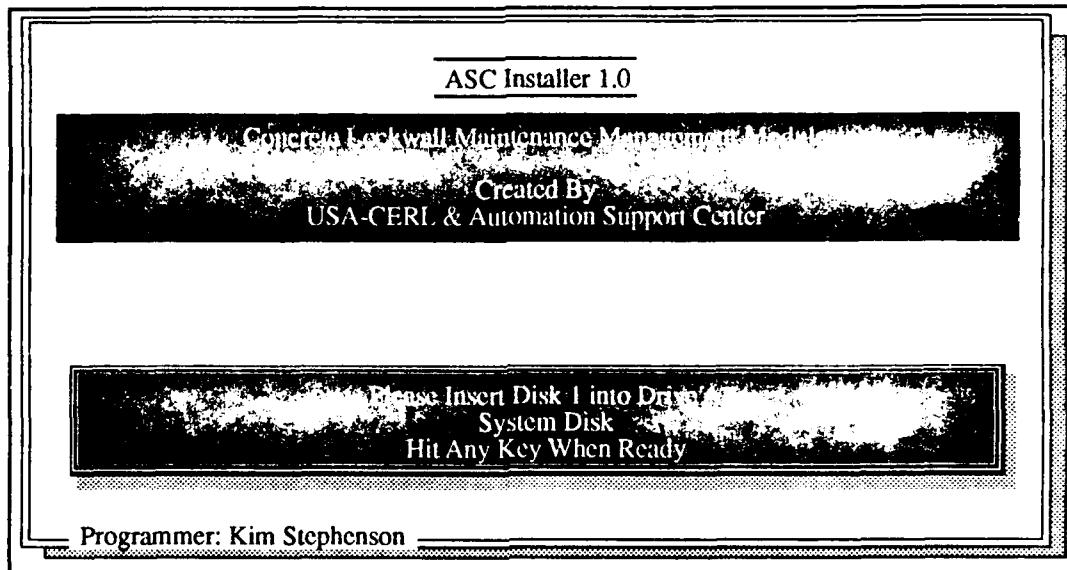
- Once the install type is selected (program or program & data), you are prompted to enter the source and destination drives. The source drive is where the original disks are. The destination drive is where Lockwall is to be installed.



- The destination directory, LOCWALL, is displayed. At this time you may change that destination directory by typing a new directory name.



7. Finally, the installer will prompt you to insert each disk as it is needed.



When the install process is complete, the **Lockwall Module** is on your local hard drive in a directory called **LOCKWALL**

ACCESSING THE **LOCKWALL MAINTENANCE MANAGEMENT MODULE**

When you are ready to access the Lockwall Module, you must be in the **LOCKER** directory.

1. Access the **LOCKER** directory. At the system prompt type:
C:> CD \LOCKER
2. Type the command **LOCKWALL** after the system prompt.
C:\LOCKER> LOCKWALL

The first Lockwall screen will now appear.

EXPLANATION OF KEYS

Three types of keys are available for use, and the function of each type of key is discussed throughout the Lockwall Module:

- Editing Keys
- Data Entry Keys
- Specialty Keys

Editing Keys

The editing keys are used for editing data being entered into the Lockwall Module. The following keys are used:

Key Name	Symbol	Function
Backspace Key	←	Backspace one space (destructive).
Delete Key	DEL	Deletes the character at the cursor position.
Insert Key	INS	Toggles the Insert Mode on / off.
Left Arrow Key	←	Backspace one space (nondestructive).
Right Arrow Key	→	Forward one space (nondestructive).

Data Entry Keys

The data entry sections of the Concrete Lockwall Condition Index System use a number of keys for cursor movement, data selection, and special functions. The system employs two different methods for data entry. The first involves selection of data from a popup menu (Type 1). The second requires you to key the data in (Type 2). Key availability and function is displayed in a box at the bottom of the screen. Figure 2 shows the data entry keys (see page 10).

Key Name	Symbol	Function
Return Key	[RETURN]	Accepts the data and moves cursor to the next data field.
Home Key	Home	Places cursor on the first data entry field.
End Key	End	Places cursor on the last data entry field.
Up Arrow Key	↑	Type 1 : Moves the highlight bar up one menu option. Type 2 : Places the cursor on the data entry field above the current field.
Down Arrow Key	↓	Type 1 : Moves the highlight bar down one menu option. Type 2 : Places the cursor on the data entry field below the current field.
Right Arrow Key	→	Type 1 : Moves the highlight bar down or to the right one menu option. Type 2 : Places the cursor on the next data entry field.
Left Arrow Key	←	Type 1 : Moves the highlight bar up or to the left one menu option. Type 2 : Places the cursor on the previous data entry field.
F1 Key	F1	Displays context sensitive help screen.
F2 Key	F2	Functions as a type 2 up arrow key for both type 1 and type 2 entry.
F3 Key	F3	Functions as a type 2 down arrow key for both type 1 and type 2 entry.
F10 Key	F10	F10 always exits the current process and returns the user to the previous screen.

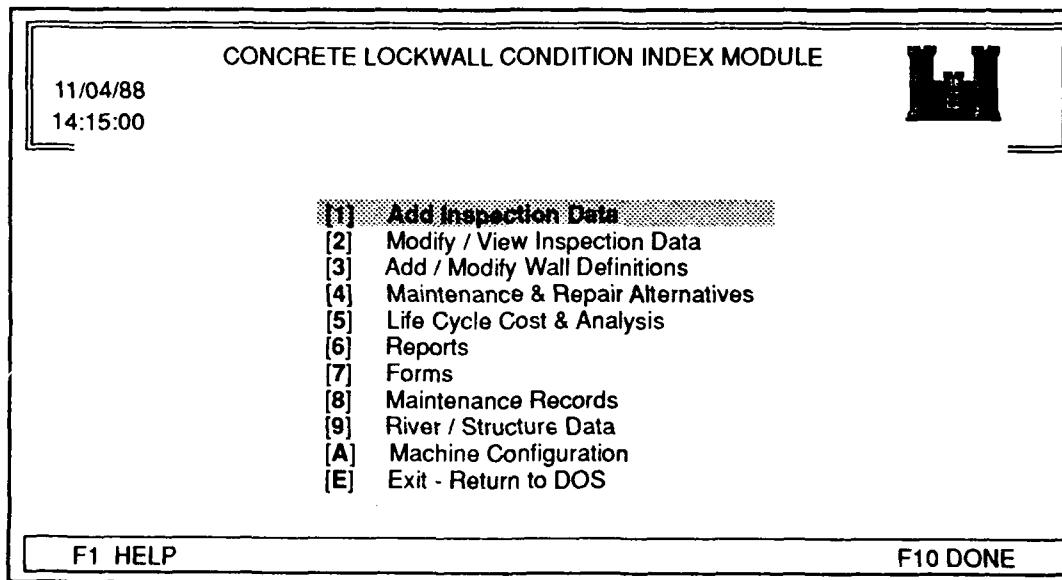
Figure 2. Data entry keys

Specialty Keys

Function Keys **F2**, **F3** and **F4** perform different actions at different locations in the system. During the data entry process they function as described above. At other times the actions are listed at the bottom of the screen in the key box.

GETTING STARTED WITH THE LOCKWALL MODULE

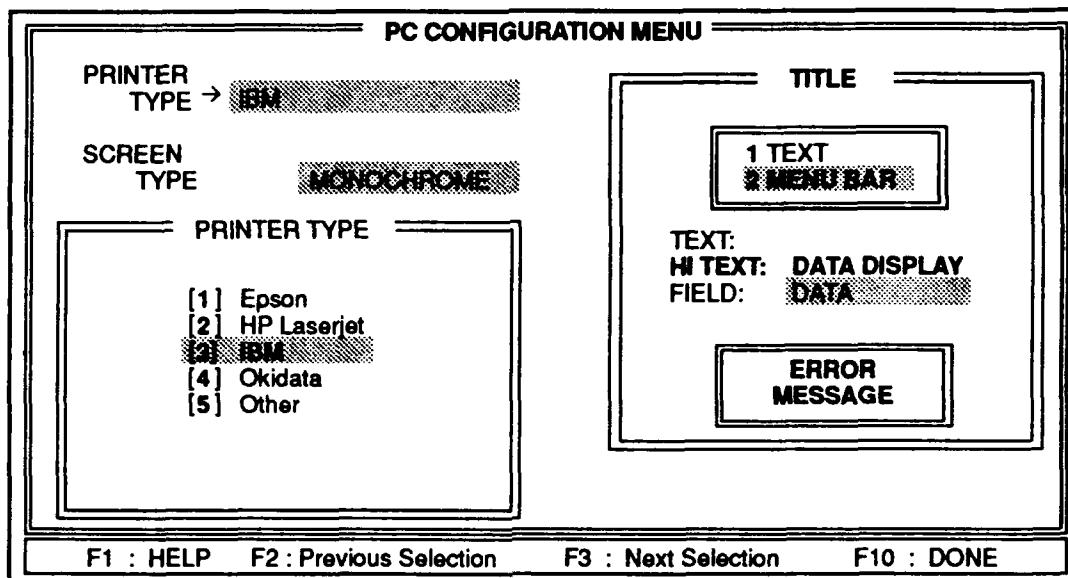
When the Concrete Lockwall Maintenance Management Module is invoked, a banner screen is displayed showing authorship and acknowledgement information. Press any key to continue to the next screen, the main menu. All options begin at this menu.



CHANGING COLORS AND CONFIGURATION

When using the Lockwall Condition Index Module on a color monitor, the ability to specify foreground and background colors, as well as printer types has been provided in the **Machine Configuration**; option **A** from the main menu. The machine configuration option provides a menu-driven method for you to modify the default settings for a number of display characteristics. When the menu for each selection is displayed, the current setting is shown as the default.

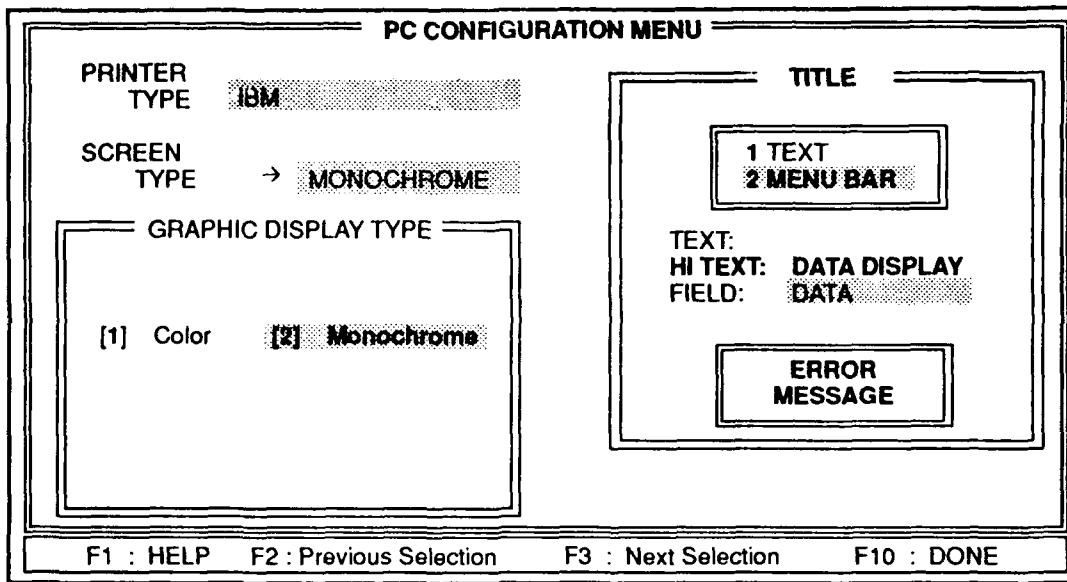
- **Printer Configuration**



The system must be configured for the proper printer to print the reports and forms. The Lockwall Module provides the parameters for four predefined printers. These are: HP Laserjet, Epson, Okidata, and IBM printer. If the appropriate printer is not available in the above listing, a fifth option, OTHER is provided. When selecting OTHER, you must supply the system with three pieces of information about the printer. First, a user-defined printer name is necessary for reference by the program. Second, the system prompts you for the graphics capabilities of the printer. Finally, it is necessary to enter the character sequence for compressed print mode. Example: (This is compressed print.) This sequence can be found in the printer manual.

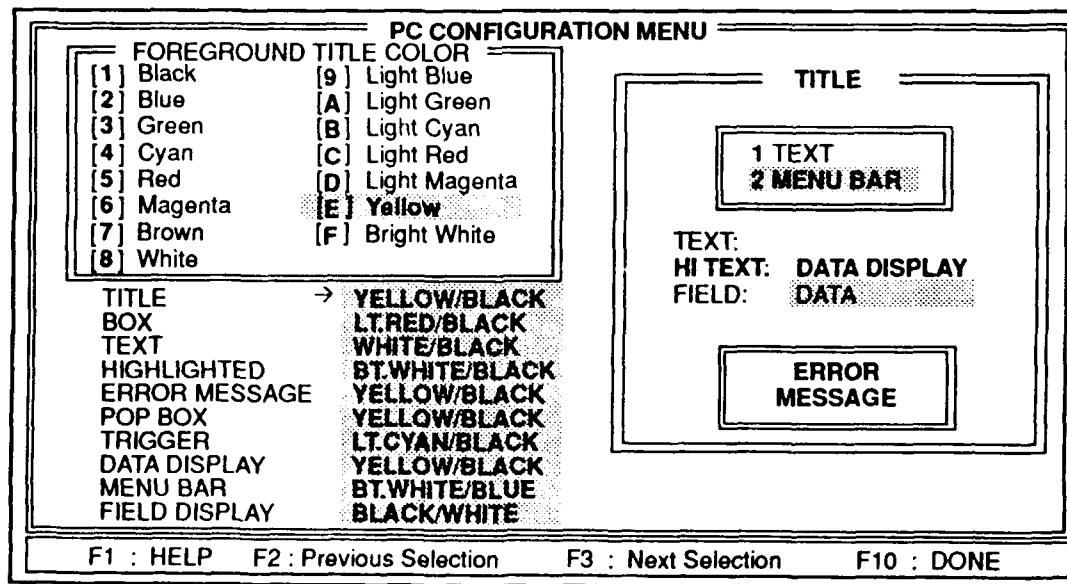
- **Screen Configuration**

The system has the ability to work with color or monochrome screens. These can be selected via the screen configuration menu. The default is a color screen.



- Screen Colors

You may specify the foreground and background colors for the following displays: titles, boxes, text, highlighted text, error messages, popup boxes, triggers, data, highlight (menu) bars, and fields. The possible color choices are selected from a menu. They are: black, blue, green, cyan, red, magenta, brown, white, light blue, light green, light cyan, light red, light magenta, yellow, and bright white.



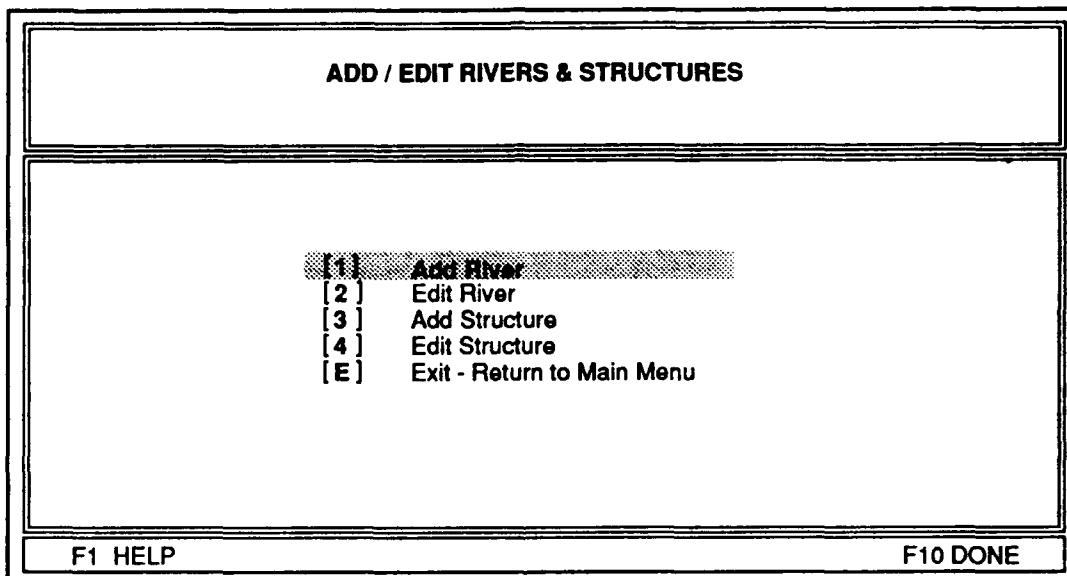
Use the arrow keys to maneuver the menu bar over the desired color and the carriage return to select it. As the colors are changed, a sample box on the right side of the screen reflects the new choices. Upon completion, you may store the new colors by pressing the F10 key and answering Y to the store changes prompt. From this point forward the Lockwall Module will reflect the new colors.

Chapter 3

River / Structure Data

ADDING AND EDITING RIVER DATA

To begin, select River/Structure Data, item 9 from the Main Menu.



- Adding a River Name

To add a river name, choose **Add River**, item 1. Type in the name of the river. Corrections may be made by using the backspace key and retyping the River Name.

Additional River Names can be entered by pressing [RETURN] after each entry. When the last River Name has been entered, press [RETURN], then F10 to return to the **Add/Edit Rivers & Structures** menu. To return to the **Main Menu**, press F10 again.

ADD RIVERS

River Name:

River Number: 10

F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom

- **Editing a River Name**

To edit a river, choose **Edit River**, item 2, on the main menu. Use the highlight bar to select the river and press **[RETURN]** to begin editing. When the river name appears on the screen, type in whatever changes are needed. You **MUST** press **[RETURN]** to save the changes. You will be prompted to save **[Y/N]**. This process may be repeated until all desired changes have been made. Then, press **F10** to return to the **Select River/Waterway System** menu.

When done editing river names, press **[F10]** to return to the **Add/Edit Rivers & Structures** menu.

ADDING AND EDITING STRUCTURE DATA

• Adding a Structure

To add a structure, choose **Add Structure**, item 3, on the main menu. Use the highlight bar to select the river. The following screen will appear:

The screenshot shows a terminal window titled "ADD STRUCTURE". The form contains the following fields:

Structure:	Black Rock Channel		
River:	Black Rock Channel		
Project:			
District:			
State:			
Mile:			
Operator:			
Lock Length:		Lock Width:	Lock Lift:
1.	2.	1.	1.
2.	3.	2.	2.
3.	4.	3.	3.
4.		4.	4.

Below the form, a status bar displays the key mapping: F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom

There are two fields that **MUST** be filled in for the program to work. It is best to enter as much information as is available. The required fields are **Structure Name** and **District ID**.

When the entire form is complete, press **[RETURN]** on the last field (Lock Lift 4) to store the data. The cursor is positioned at the structure name field in preparation for the next structure. Press **F10** when finished entering structures.

• Editing a Structure

To edit a structure, choose **Edit Structure**, item 4. Use the highlight bar to select a river. Use the highlight bar to select a structure and press **[RETURN]** to begin editing.

The river name and structure name will be displayed at the top of the screen. Type in the needed changes. You **MUST** press **[RETURN]** after making changes or they will not be saved. Then press **F10**, **S** to save, and **Y** to confirm the save. You can then select another structure to edit or press **F10** to return to **Select River/Waterway System** menu.

Chapter 4

Concrete Wall Definition and Modification

DATA ENTRY AND MODIFICATION

This chapter details the processes by which data is entered and modified by the Lockwall Module. The process of calculating a condition index for a concrete monolith requires several types of data to be stored by the system. These are:

- **River Data** This data base contains a list of rivers for the division. A mechanism is provided by the Lockwall Module to add and edit this list. This data base is in place when the system is delivered.
- **Structure Data** This data base contains the structures located within the division. As with the river data base, the system provides a method to add and edit the provided structure list. This data base is in place when the system is delivered.
- **Wall Definitions** To handle the inspection data properly, you must create a list of the walls for each lock. This data base contains a wall type, unique wall identifier, comment, and a list of the monoliths within the wall. The monolith ID numbers are obtained from the engineering drawings for the lock.
- **Inspection Data** This data is collected during a visual inspection of the lock. It includes: the presence or absence of any defects, the distress type, description, and location.

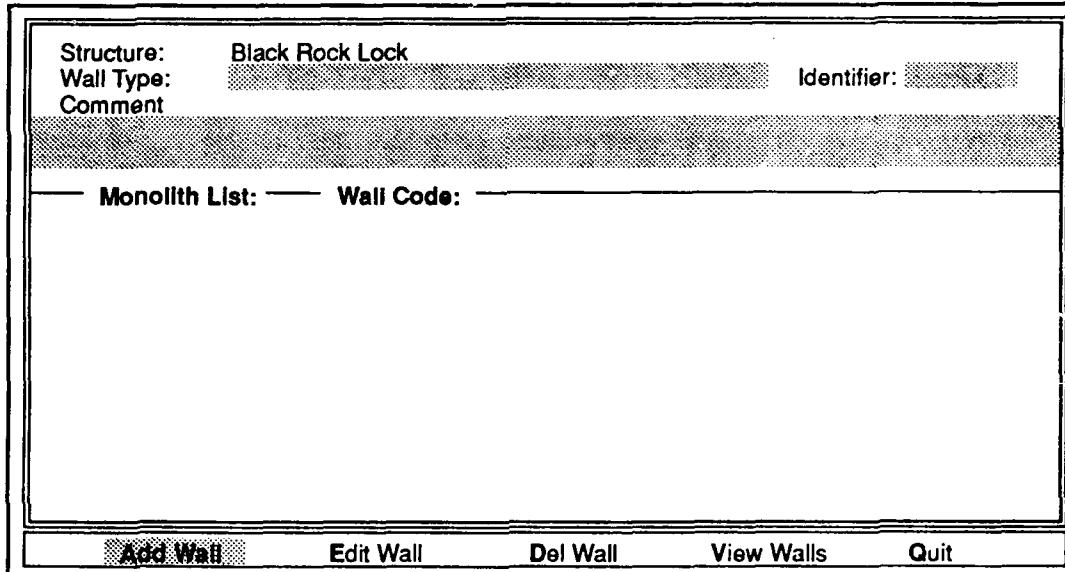
DEFINING A WALL

Before any inspection data can be processed by the Lockwall Module, all lock chamber walls, guide walls, and their respective monoliths must be defined. The data necessary to define the lock walls may be found on the construction drawings for the lock. There are two methods to begin the wall definition procedure.

- Select the **Add / Modify Walls**, option 3, from the main menu.

- An alternate method to begin the wall definition process is to select the **Add Inspection Data**, option 1, from the main menu. After selecting a river and a structure, the system determines that no walls have been defined. At this point the system goes automatically to the wall definition screens.

Whether selecting option 1 or option 3 from the main menu, the system will prompt you to pick a river and a structure on which to define the walls. The wall definition screen is then displayed with a menu for add, edit, delete, and view at the bottom.



Use the cursor keys to move the highlight bar over the option **ADD** and press **[RETURN]**. Defining a wall involves the storage of four types of information.

- Wall Type** Also known as **Wall Name**, the wall type is a required field which describes the function of the wall. Once in add mode, the cursor will move to the first field and present you with a menu from which to select the wall type.
- Wall Identifier** The wall identifier field is required only if more than one of that wall type is present in the lock; i.e., a multi-lock structure that has two intermediate walls. If only one wall of that type exists, this is an optional field. The identifier field is used to distinguish between similar walls.
- Comment** The optional comment field provides you with a place to store up to 156 characters of text about the walls.
- Monolith List** This group of data consists of the numbers for all the monoliths that compose the wall.

Define a Wall

Structure:	Black Rock Lock	
Wall Type:	Guard Wall	
Comment	This is a comment field.	
Monolith List: — Wall Code: —		
1	2	3
7	8	9
103	104	105

Wall Type

Guard Wall

- Upper Guide Wall
- Lower Guide Wall
- Main Chamber Land Wall
- Main Chamber River Wall
- Intermediate Wall
- Other

F1 HELP : F10 DONE : ↑↓ = Menu Bar : ←→ Home/End F2/F3 = Change Field/Wall

A wall may be defined as: Guard Wall, Lower Guide Wall, Upper Guide Wall, Main Chamber Land Wall, Main Chamber River Wall, Intermediate Wall, or Other. If the required wall is not in the menu list, select the option **OTHER**. The cursor is placed on the wall type field and waits for you to enter a name for the wall.

The wall identifier is an optional field if it is the first wall of the specified type.

Define a Wall

Structure:	Black Rock Lc k
Wall Type:	Guard Wall
Comment	
Monolith List: — Wall Code: GR01	

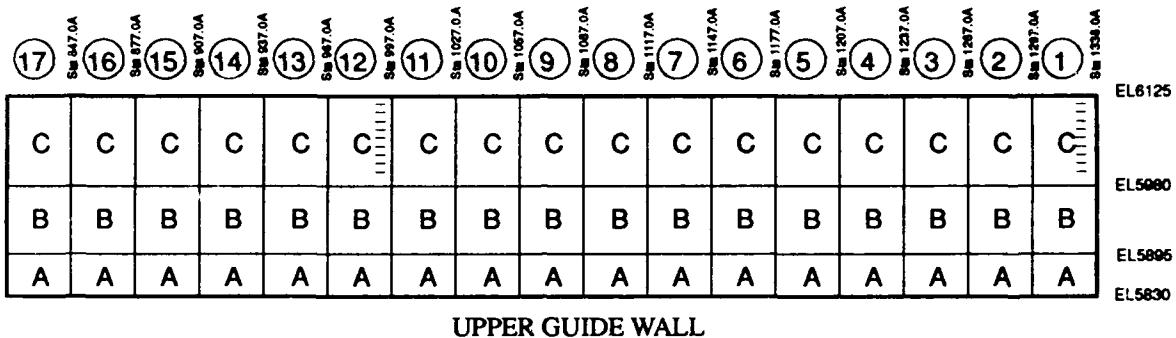
Identifier: ←

F1 HELP : F10 DONE : ←→ ↑↓ Home/End = Change Field : F2/F3 = Prev/Next Wall : F4 Del

One exception to this rule is a wall type of **OTHER**. For **OTHER**, an identifier is always required. It will later be appended onto the monolith number to make that monolith ID unique. Additionally, when a second entry is made for guard walls through intermediate walls, all entries of that wall type require an identifier. If the first wall entry does not already have one, a box will be displayed requesting the new ID.

The comment field is an optional space to record any pertinent data about the wall as a whole.

The final piece of data is the monolith listing. The data to input here can be found on the blueprints for the lock. Below is an example section of a lock blueprint. In this example, the upper guide wall consists of monoliths 1 through 17.



When entering the monoliths, up to 36 monoliths may be displayed at a time. After keying each monolith in, press a carriage return. When adding or editing a wall, the active keys are displayed at the bottom of the screen.

Arrow Keys

Move the cursor from field to field around the screen.

Home / End

Moves the cursor to the first / last defined monolith for that wall.

F2

Moves the cursor to the field directly above the current field. When the current field is the wall type the system scrolls to a previously added wall.

F3

From the wall type field, F3 moves the cursor to the field directly below the current field. At all other fields, F3 will cause the system to scroll to the next defined wall.

F4

F4 deletes a monolith from the wall list. Pressing F4 a second time on the same monolith cancels the deletion.

EDITING A WALL

Adding and editing a wall are very similar processes. To begin, select **Add / Modify Walls**, option 3, from the main menu. Select a river and a structure. A new menu will be displayed at the bottom of the screen. Select the **Edit** option. A list of all the defined walls for this structure will be displayed.

Define a Wall

Structure:	Black Rock Lock	Identifier:	
Wall Type:			
Comment:			
Monolith List:		Wall Code:	SELECT A WALL
Guard Wall		T1	
Lower Guide Wall		T2	
Main Chamber River Wall		T5	
Intermediate Wall		T6	
Last Wall		T8	

Return to Edit **F10 : DONE**

Use the arrow keys to place the highlight bar over the wall and press return. If no wall is desired, **F10** will return you to the **Add / Edit / Delete / View** menu. After selecting a wall to edit, the same data entry screen as used in the **Add Mode** is displayed. Make the necessary changes, scroll to a previous or next wall or press **F10** to exit the edit screen. You will be prompted whether to store the changes.

DELETING A WALL

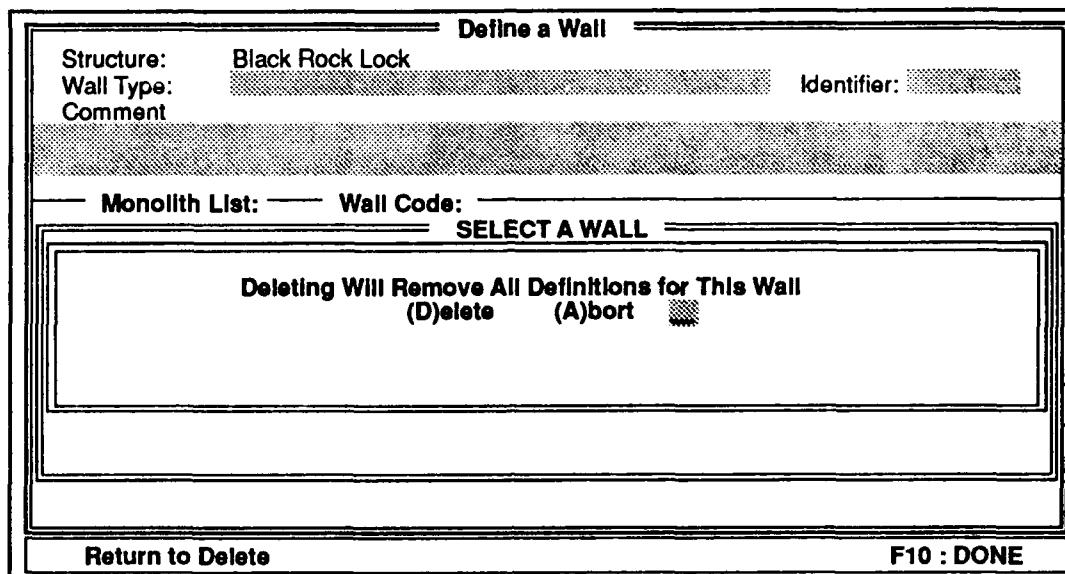
After selecting **Add / Modify Walls**, option 3, on the main menu and **Delete** from the wall menu, a list of all the walls defined as part of that structure is displayed.

Define a Wall

Structure:	Black Rock Lock	Identifier:	
Wall Type:			
Comment:			
Monolith List:		Wall Code:	SELECT A WALL
Guard Wall		T1	
Lower Guide Wall		T2	
Main Chamber River Wall		T5	
Intermediate Wall		T6	
Last Wall		T8	

Return to Delete **F10 : DONE**

Using the arrow keys, page up and page down to place the highlight bar over the desired wall. Press [RETURN] to delete the wall. You will be prompted to actually delete the wall.



To continue the delete, press **D**. All data associated with this wall will be removed. If a wall is deleted, it may be recovered if you have not exited back to the wall menu, simply press [RETURN] again.

VIEWING A WALL

Select **Add / Modify Walls**, option 3, on the main menu. Then select **View** from the wall menu. As in the edit and delete modes, a list of the defined walls will be displayed. Use the arrow keys to place the highlight bar over the desired wall. Press [RETURN] to select the wall. The data describing the wall will be displayed. The only active keys are the arrow keys, **F2**, and **F3**. These are used to scroll between walls.

In view mode, only the first 36 monoliths defined for that wall will be displayed. Any other monoliths may be seen in edit mode or on the wall definitions report. The wall definitions report is a printed report detailing the wall description. It will be described in the Reports and Forms chapter.

Chapter 5

Distress Data Entry and Modification

DEFINING A DISTRESS

A distress is a defect found in a concrete monolith. There are five general types of distress: cracking, volumetric cracking, steel, leakage, and other. Each type is divided into two or more specific distress categories.

Cracking:	Horizontal, Vertical & Transverse, Vertical & Longitudinal, Diagonal, Random, and Longitudinal Floor.
Volumetric:	Checking, D-Cracking, Pattern, Abrasion, Honeycomb, Pop-outs, Scaling, Spalling, and Disintegration.
Exposed Steel:	Reinforcing (Exposed) Steel and Prestressed Steel.
Leakage:	Leakage and Deposits.
Other:	Spalled Joint, Corrosion Stains, and Damaged Armor.

Once a distress type is selected, a **data entry screen** will be displayed prompting you for information about the distress.

All five general distress types prompt you for three things, **the specific distress type, location of the distress on the monolith, and a remark**. The **specific distress** and the **location** are **required pieces of data**. The **remarks**, however, is an **optional** space of up to 255 characters for a distress description. In addition to the above three pieces of data, each general distress type requires information about the distress size. The following description details the data specific to general type:

- **Cracking:**

The general category cracking requires you to enter the **width** and **units of measure** for the crack in question. These are **required** fields.

- **Volumetric Cracking:**

This distress category requires more data entry than the others. The Condition Index (CI) algorithm requires enough information to compute the percentage of volume of concrete that has been lost as compared to the as-built condition, i.e., what percentage of the monolith is missing due

to volumetric cracking? The LOCKWALL program allows the entry of data expressed as absolute measurements of inches or millimeters, in which case the program calculates the percentage; or the data may be entered as the percentage of the total width and total depth of the monolith affected by the volume loss type distress. Additional fields are provided for completeness but they are not required for calculating the CI.

- **Steel, Leakage, & Others:**

The remaining three general categories (Steel, Leakage, and Others) require the same pieces of data; an **amount of distress**. This is selectable from a menu and is generally **over 50%, under 50%, light, medium, or heavy**.

- **Special Note:**

For exposed prestressed steel, it is not necessary to indicate the **AMOUNT** that is exposed. However, for reinforcing steel, the **AMOUNT** field is required.

If you **omit** a piece or pieces of required data during data entry and you attempt to **store** the incomplete record, a message will appear informing you that the data is **Suspect**. You must then decide to continue storing the incomplete data and go on or go back and complete the data entry. The missing field(s) will be displayed in the message. Any records flagged as **Suspect** in the data base **will not be used when calculating the Condition Index** for the monolith. Once the data is stored as **Suspect**, its status may be altered by entering the missing data in **edit mode**.

- **Related Distress**

For **volumetric cracking, only**, there is the potential for distresses to be **related**. Volumetric cracking represents a **loss of section** on the monolith. If such a loss occurs on both the **landside** and the **riverside** face of the monolith at the **same elevation** on the monolith, the **depth** of the section is **reduced** from **both directions** at the **same time**. Such **dual reductions** must be accounted for. These distresses are considered **related groupings**. A group may contain two or more distresses. The distresses, however, **must be at the same elevation on opposing faces** of the monolith.

To enter distress groupings, enter all the distresses for the monolith as described later in this chapter. When the data entry is complete, select **No Other Defects** from the data menu and **quit** from the **Add/Edit/Delete/View** menu. At this time, the following screen will appear:

<p>You have indicated a loss of section on both the RIVERSIDE & the LANDSIDE faces of the monolith. Below are listed the loss of section DISTRESS(ES)/ WIDTH / DEPTH existing on each side of the monolith.</p> <p>Group the distresses existing at the same elevation on opposing faces of the monolith by entering distress FACE CODE & DISTRESS NUMBER one at a time. When all the distresses at one elevation are entered press F2 to begin a new group. A group may consist of 2 or more distresses.</p> <table> <tbody> <tr><td>R 1.</td><td>Riverside</td><td>Width</td><td>Depth</td><td>L 1.</td><td>Landside</td><td>Width</td><td>Depth</td></tr> <tr><td></td><td>D-Cracking</td><td>50.00%</td><td>20.00%</td><td></td><td>Checking</td><td>100.00%</td><td>10.00%</td></tr> <tr><td>R 2.</td><td></td><td></td><td></td><td>L 2.</td><td></td><td></td><td></td></tr> <tr><td>R 3.</td><td></td><td></td><td></td><td>L 3.</td><td></td><td></td><td></td></tr> <tr><td>R 4.</td><td></td><td></td><td></td><td>L 4.</td><td></td><td></td><td></td></tr> <tr><td>R 5.</td><td></td><td></td><td></td><td>L 5.</td><td></td><td></td><td></td></tr> <tr><td>R 6.</td><td></td><td></td><td></td><td>L 6.</td><td></td><td></td><td></td></tr> <tr><td>R 7.</td><td></td><td></td><td></td><td>L 7.</td><td></td><td></td><td></td></tr> </tbody> </table> <p>Group 1: Enter Face (R/L) Distress Number (1 - 7)</p>							R 1.	Riverside	Width	Depth	L 1.	Landside	Width	Depth		D-Cracking	50.00%	20.00%		Checking	100.00%	10.00%	R 2.				L 2.				R 3.				L 3.				R 4.				L 4.				R 5.				L 5.				R 6.				L 6.				R 7.				L 7.			
R 1.	Riverside	Width	Depth	L 1.	Landside	Width	Depth																																																															
	D-Cracking	50.00%	20.00%		Checking	100.00%	10.00%																																																															
R 2.				L 2.																																																																		
R 3.				L 3.																																																																		
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R 6.				L 6.																																																																		
R 7.				L 7.																																																																		
F1: HELP F2: Next Group F3: Prev Group F4: Display DEL: Del Group F10: DONE																																																																						

The **landsides distresses** are displayed on the right side of the screen and are coded **L1** through **L7** and so on. The **riverside distresses** are shown on the left side of the screen and are coded **R1** through **R7**. To enter a grouping, press **L** or **R** for the face code and then the number corresponding to the desired distress. Up to 7 **distresses** for each side will be displayed at one time. To see the **next/previous** set of seven, press page **down** or page **up**.

F2 and **F3** keys will scroll between groupings; **F2** for the next group, **F3** for the previous. To display all the groupings at once, press **F4**. The following screen will appear:

<p>Group 1: Distress Relationships D-Cracking-R1 + Checking-L1</p>																																																																						
<table> <tbody> <tr><td>R 1.</td><td>Riverside</td><td>Width</td><td>Depth</td><td>L 1.</td><td>Landside</td><td>Width</td><td>Depth</td></tr> <tr><td></td><td>D-Cracking</td><td>50.00%</td><td>20.00%</td><td></td><td>Checking</td><td>100.00%</td><td>10.00%</td></tr> <tr><td>R 2.</td><td></td><td></td><td></td><td>L 2.</td><td></td><td></td><td></td></tr> <tr><td>R 3.</td><td></td><td></td><td></td><td>L 3.</td><td></td><td></td><td></td></tr> <tr><td>R 4.</td><td></td><td></td><td></td><td>L 4.</td><td></td><td></td><td></td></tr> <tr><td>R 5.</td><td></td><td></td><td></td><td>L 5.</td><td></td><td></td><td></td></tr> <tr><td>R 6.</td><td></td><td></td><td></td><td>L 6.</td><td></td><td></td><td></td></tr> <tr><td>R 7.</td><td></td><td></td><td></td><td>L 7.</td><td></td><td></td><td></td></tr> </tbody> </table> <p>Group 1: Enter Face (R/L) Distress Number (1 - 7)</p>							R 1.	Riverside	Width	Depth	L 1.	Landside	Width	Depth		D-Cracking	50.00%	20.00%		Checking	100.00%	10.00%	R 2.				L 2.				R 3.				L 3.				R 4.				L 4.				R 5.				L 5.				R 6.				L 6.				R 7.				L 7.			
R 1.	Riverside	Width	Depth	L 1.	Landside	Width	Depth																																																															
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R 7.				L 7.																																																																		
F1: HELP F2: Next Group F3: Prev Group F4: Display DEL: Del Group F10: DONE																																																																						

To delete a single distress from the group, simply reenter the face code and associated number. Deleting an entire group may be accomplished by pressing the delete key while the highlight bar is on that group.

If a distress itself is deleted and that distress is part of a related group, the entire group will be deleted as well. If the remaining distresses are still related, the groups must then be reentered.

INSPECTION DATA ENTRY

The process of entering condition inspection data begins at the main menu. Select option [1] Add Inspection Data, and a list of River/Waterway Systems is presented.

River:	Black Rock Channel
Structure Name:	
Downstream City:	
 Black Rock Channel Calumet River Chicago Sanitary and Ship Canal Fox River Illinois River Mississippi River Sandy River South St. Mary's River St. Mary's River	
- use arrow keys to highlight your choice - - press ENTER to select -	
F1 HELP	F10 DONE

Using the arrow keys, highlight the desired River and press [RETURN]. You will then be presented with a list of structures for that river.

River:	Black Rock Channel
Structure Name:	Black Rock Lock
Downstream City:	Buffalo

Black Rock Lock **NCB**

- use arrow keys to highlight your choice -
- press ENTER to select -

F1 HELP **F10 DONE**

The list may be longer than what is shown on the screen. The page down and page up keys may be used to flip to the next (or previous) screen. Simply highlight the Structure desired and press [RETURN].

Structure:	Black Rock Lock		
River:	Black Rock Channel		
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR		
District:	NCB		
State:	NY		
Mile:	Chambers: 1		
Operator:	DAEN NCD		
Lock Length:	Lock Width:	Year Complete:	1914
1. 625	1. 68	Monolith:	1. 5
2.	2.		2.
3.	3.		3.
4.	4.		4.

LOCAL STRUCTURE INVENTORY

Inspection Date: Enter Inspection Team
Location: Monolith #:
Gate Block?: Distress Present?:

F1 HELP **F10 DONE**

The program moves to the Local Structure Inventory box (shown on previous page). The cursor is prompting for the Inspection Date. After the date is entered in MM/YY format, the Inspection Team Data popup box is displayed.

Structure:	Black Rock Lock
River:	Black Rock Channel
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR
District:	NCB
State:	NY
Mile:	
Operator:	DAEN NCD
Lock	Chambers: 1
Inspect	Year Complete: 1914
Gate	Monolith:
ENTER INSPECTION TEAM DATA	
BLACK ROCK LOCK	
Append Mode	F10 - Menu
LAST NAME:	[REDACTED]
FIRST NAME:	[REDACTED]
PHONE:	[REDACTED]
ADDRESS:	[REDACTED]
OFFICE:	[REDACTED]
<input type="button" value="Next"/> <input type="button" value="Prev"/> <input type="button" value="First"/> <input type="button" value="Last"/> <input type="button" value="Edit"/> <input type="button" value="Append"/> <input type="button" value="Delete"/> <input type="button" value="Quit"/>	

The menu at the bottom of the screen provides the capability to see additional Team Data that may exist for this lock and inspection data. Highlight the Next, Previous, First, and Last options to view the various records. To Edit, Append, and Delete data, simply highlight the appropriate option and press [RETURN].

After Inspection Team Data is complete, you are prompted to select a wall from a list. Simply highlight the appropriate Wall and press [RETURN].

Structure:	Black Rock Lock
River:	Black Rock Channel
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR
District:	NCB
State:	NY
Mile:	
Operator:	DAEN NCD
Chambers: 1	Year Complete: 1914
Monolith:	
SELECT A WALL	
<input type="checkbox"/> Lower Guide Wall	<input type="checkbox"/> LW01
<input type="checkbox"/> Upper Guide Wall	<input type="checkbox"/> UP01
<input type="checkbox"/> Intermediate Wall	<input type="checkbox"/> IT01
<input type="button" value="F1 LIST MONOLITHS"/> <input type="button" value="F10 DONE"/>	

Control is then returned to the **Local Structure Inventory** box with the cursor at the **Monolith** field. Enter the appropriate **Monolith Number**. If the monolith entered is not defined as part of the wall, the system presents you with three options: **Select a different wall**, **Return** and select a different monolith, or **Add this monolith to this wall**.

Structure:	Black Rock Lock	Year Complete:	1914
River:	Black Rock Channel	Chambers:	1
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR		
District:	NCB	Owner:	DAEN NCD
State:	NY	City:	Buffalo
Mile:			
Operator:	DAEN NCD	Monolith:	
This Monolith is NOT Defined as Part of This Wall Wall: Land Wall LW01 Monolith: 30			
1. Select a Different Wall 2. Enter a Different Monolith Number 3. Add This Monolith to This Wall			
Enter Choice: <input type="checkbox"/>			
Gate Block?:	<input type="checkbox"/>	Distress Present?:	<input type="checkbox"/>
F1 HELP		F10 DONE	

Selecting the first option will result in returning to the **Select a Wall** screen. If option two is selected, you are returned to the **Local Structure Inventory** window. Place the cursor on the **Monolith** field to select a different Monolith number. If the third option is selected, the following questions will be asked: **Is this a Gate Block?** and **Is Distress Present?** Highlight the proper answers, pressing [RETURN] after each selection.

DISTRESS TYPE ENTRY

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Add Mode			
Select Defect Type:		# of Defects	
<input checked="" type="checkbox"/> No Other Defects			
Cracking 0 Volume Loss / Deterioration 0 Steel 0 Other Damages 0 Leakage and Deposits 0			
TOTALS		0	
F1 HELP		F10 DONE	

There are five distress types. They are shown in the screen on the previous page as the second through the sixth options on the bounce-bar menu.

The first option, **No Other Defects**, is available for use after all defects (distresses) have been identified. Choosing this option allows you to change the mode to **Add**, **Edit**, **Delete**, or **View**.

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L

Add Mode

Select Defect Type:	# of Defects
No Other Defects	0
Cracking	0
Volume Loss / Deterioration	0
Steel	0
Other Damages	0
Leakage and Deposits	0
TOTALS	0

Add Data **Edit Data** **Delete Data** **View Data** **Quit**

• Cracking Type Distress Entry

As shown below, there are six categories of **crack distresses**. In the bounce-bar menu, simply highlight the proper choice and press **[RETURN]**.

CRACKING		
River:	Black Rock Channel	
Structure Name:	Black Rock Lock	
Downstream City:	Buffalo	
Category:	← Width:	
Remarks:		
CRACK CATEGORY		
24 Horizontal		
25 Vertical & Transverse		
26 Vertical & Longitudinal		
27 Diagonal		
28 Random		
29 Longitudinal Floor		
Category:	Width:	Location:
Remarks:		

F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down

After selecting the category of **crack distress**, the small selection box disappears and the cursor moves to the **width** field on the main data entry screen. Use the **period key** to indicate the position of the decimal.

CRACKING		
River: Structure Name: Downstream City:	Black Rock Channel Black Rock Lock Buffalo	Monolith: 1 Gate: N Location: L
Category: Remarks:	Width: <input type="text"/>	← Location: <input type="text"/>
Category: Remarks:	Width: <input type="text"/>	← Location: <input type="text"/>
F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom		

A popup box then appears and asks for the **unit of measurement** used (to determine the width). The options are either **Inches** or **Millimeters**. Either may be selected; the selection then appears in the unlabeled field to the right of **Width**.

CRACKING		
Riv Str Do	Black Rock Channel Black Rock Lock Buffalo	Monolith: 1 Gate: N Location: L
UNITS	Width: <input type="text"/> .02	← Location: <input type="text"/>
Inches Millimeters		
Category: Remarks:	Width: <input type="text"/>	← Location: <input type="text"/>
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

At this point, another small box pops up to request the **crack location**. There are five possible choices. After choosing one, the next field is for remarks. Use this for any additional references or comments.

CRACKING		
River: Structure Name: Downstream City:	Channel Lock	Monolith: 1 Gate: N Location: L
CRACK LOCATION		
<input checked="" type="checkbox"/> Land Side Face <input type="checkbox"/> River Side Face <input type="checkbox"/> Deck <input type="checkbox"/> Conduit <input type="checkbox"/> Floor		Width: .02 IN Location: ←
Category: <input type="text"/> Remarks:		Width: <input type="text"/> IN Location: <input type="text"/>
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

If there is only one crack type distress for this monolith, use the **F10** key to indicate you are finished entering crack type distress data. A small box pops up and asks whether to **(A)abort** (**S**ave or **C**ontinue Editing). **Abort** means to stop and not save the current data. **Continue editing** will allow editing of the current data, and/or additional data to be entered. **Save** will record the current entry and return to the previous menu of defect types.

CRACKING		
River: Black Rock Channel Structure Name: Black Rock Lock Downstream City: Buffalo	Monolith: 1 Gate: N Location: L	
Category: <input type="text"/> Horizontal Remarks:	Width: <input type="text"/> .02 IN Location: ←	
(A)abort (S)ave (C)continue Editing Enter Choice <input type="text"/>		
Cat Remarks:		
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

If there are more crack type distresses for this monolith, press **enter** on the **remarks field** and continue to the lower half of the screen to make an entry for a second distress. The lower entry screen is then used for all **additional distresses** with the top screen reserved for the last entry. The **F2** and **F3** keys may be used to scroll among all the distresses, for viewing or editing, after they have been entered. At any time, the **F10** key may be used to indicate you are **Done** or have completed data entry. The data entry screen is removed and the previous menu, **defect types**, reappears.

- **Volume Loss Type Distress Entry**

The third option of the **Select Defect Type** menu is **Volume Loss / Deterioration**. Upon selection of this distress type, you are presented with a list of 10 categories of **Volume Loss**.

VOLUME LOSS TYPE CRACKING / DETERIORATION	
River:	Black Rock Channel
Structure Name:	Black Rock Lock
Downstream City:	Buffalo
Distress Category:	← [Bounce Bar]
Distress Dimensions:	
Width:	[Bounce Bar]
Depth:	[Bounce Bar]
Height:	[Bounce Bar]
Elevs:	[Bounce Bar]
Remarks:	
DISTRESS CATEGORY	
21 Checking	
22 D-Cracking	
23 Pattern	
31 Abrasion	
32 caVitation	
33 Honeycomb	
34 pOp-Outs	
35 Scaling	
36 spaLling	
37 disinTegration	

F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down

The bounce-bar allows easy selection of the proper category. The return key selects the category title and places it in the main entry screen.

Immediately, another small box appears on the left side of the screen asking for the **distress location**. Select the one description that best fits and press [RETURN].

VOLUME LOSS TYPE CRACKING / DETERIORATION	
River:	Black Rock Channel
Structure Name:	Black Rock Lock
Downstream City:	Buffalo
DISTRESS LOCATION <input type="checkbox"/> Land Side Face <input type="checkbox"/> River Side Face <input type="checkbox"/> Deck <input type="checkbox"/> Conduit <input type="checkbox"/> Floor	
Height:	<input type="text"/>
Elevs:	<input type="text"/>
Remarks:	<input type="text"/>
Location: <input type="text"/> Section Dimensions: (at elevation of distress) Width: <input type="text"/> Depth: <input type="text"/>	
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down	

The small popup box dissolves and the cursor moves to the **Width** field of the main entry screen.

VOLUME LOSS TYPE CRACKING / DETERIORATION	
River:	Black Rock Channel
Structure Name:	Black Rock Lock
Downstream City:	Buffalo
Monolith: 1 Gate: N Location: L	
Distress Category:	<input type="text"/> Checking
Distress Dimensions:	<input type="text"/> Location: <input type="text"/> River Side Face
Width:	<input type="text"/>
Depth:	<input type="text"/>
Height:	<input type="text"/>
Elevs:	<input type="text"/>
Remarks:	<input type="text"/>
Section Dimensions: (at elevation of distress) Width: <input type="text"/> Depth: <input type="text"/>	
F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom	

All the **size** fields accept numeric entries only. The **Distress Dimensions Width** and **Depth** fields accept accuracy to 2 decimal places. The **Height** field and **Section Dimensions Width** and **Depth** fields accept only a single decimal place. The last **size** field is **Elevation**, but this is not numeric and is not used in the CI calculation.

After each size field is entered, the **Units** box pops up to display five possible units of measure. It is recommended that the same unit of measure be used for all fields, but it is not required. The last field on the main entry screen is for **remarks**.

VOLUME LOSS TYPE CRACKING / DETERIORATION

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Distress Category: Checking		River Side Face	
Distress Dimensions:		Dimensions: (of distress)	
Width:	15.00	Length:	15.00
Depth:	15.00	Height:	15.00
Height:	15.00	Elevs:	15.00
Remarks:			

UNITS

Centimeters
Meters
Percent
Inches
Feet

F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom

Two distress locations deserve special comment. Any distress located on a **Deck** is handled differently. After selecting **Deck**, you are presented with a popup box that asks for the **Percentage of the Deck Affected**. This entry is numeric with up to 2 decimal places allowed. After entry, the popup box disappears and the cursor moves to remarks. These are the only fields needed for a volume type distress located on a deck.

VOLUME LOSS TYPE CRACKING / DETERIORATION

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Distress Category: Checking		Location: Deck	
Enter the Percentage (%) of the Deck Effected <input type="text"/> % ←			
Remarks:			

F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom

The other special case is for Cavitation distress. Since cavitation can only occur in a conduit, when this category is selected, a popup box appears and the user is asked to supply the Depth of Cavitation in the Conduit in inches. Next, the cursor moves to the remarks field and that is all the data entry required within the cavitation distress category.

VOLUME LOSS TYPE CRACKING / DETERIORATION		
River:	Black Rock Channel	Monolith: 1
Structure Name:	Black Rock Lock	Gate: N
Downstream City:	Buffalo	Location: L
Distress Category: Abrasion		Location: Conduit
Enter the Depth of the Abrasion In the Conduit (In) <input type="text" value="IN ←"/>		
Remarks: 		
F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom		

- Steel Type Distress Entry

The fourth option of the Select Defect Type menu is Steel. There are just two choices within this distress type: Reinforcing and Prestress.

STEEL		
River:	Black Rock Channel	TYPE OF STEEL <input type="checkbox"/> 42 Reinforcing (Exposed) <input type="checkbox"/> 43 Prestress (Any Exposure/Corrosion)
Structure Name:	Black Rock Lock	
Downstream City:	Buffalo	
Type:	<input type="text"/> ← Location:	
Remarks:	 	
Type:	Location:	Amount:
Remarks:	 	
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

After selecting the distress type, you are asked for the **Distress Location**. There are five possibilities, Land Side Face, River Side Face, Deck, Conduit, and Floor.

DISTRESS LOCATION		STEEL	
River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
		Location:	← Amount:
Type:		Location:	Amount:
Remarks:			
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down			

After highlighting and selecting the Distress Location, the only field left to enter is remarks. When complete, press [RETURN] to continue to add Steel type distresses or the **F10** key to stop and return to the **Select Defect Type** menu.

• Other Type Distress Entry

The **Other** distress category has three distress types. They are: **Spalled Joint**, **Corrosion Stain**, and **Damaged Armor**.

OTHER DAMAGES			
River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Type:	← Location	TYPE OF OTHER DAMAGES	
Remarks:	<div style="border: 1px solid black; padding: 5px;"> 36 Spalled Joint 41 Corrosion Stain 44 Damaged Armor </div>		
Type:	Location:	Amount:	
Remarks:			
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down			

The Other Distress Type is limited to two general locations: Land Side Face or River Side Face. These data selections are handled by popup box menus.

R
S
D

OTHER DAMAGES

DISTRESS LOCATION

Lock Channel
Lock Lock

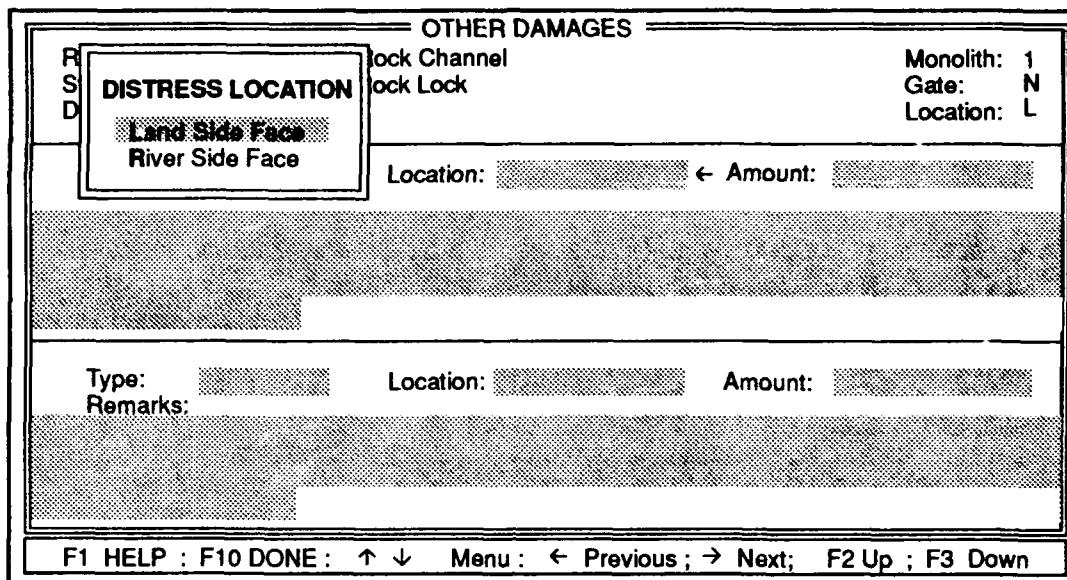
Monolith: 1
Gate: N
Location: L

Land Side Face
River Side Face

Location: [REDACTED] ← Amount: [REDACTED]

Type: [REDACTED] Location: [REDACTED] Amount: [REDACTED]
Remarks: [REDACTED]

F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down



The last popup asks for the **Amount of Other Damages**, with just two choices: Light or Heavy. After making a selection here, the cursor moves to the remarks field. When finished, press **F10** to stop or simply [RETURN] to continue entering distresses.

R
S
D

OTHER DAMAGES

AMOUNT OF OTHER DAMAGES

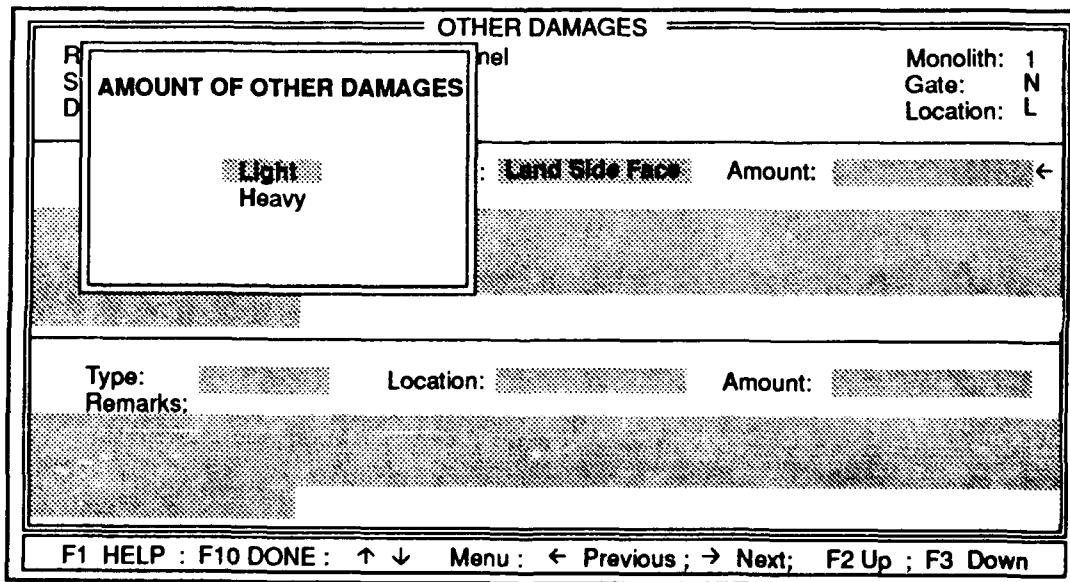
Light
Heavy

Monolith: 1
Gate: N
Location: L

: Land Side Face Amount: [REDACTED] ←

Type: [REDACTED] Location: [REDACTED] Amount: [REDACTED]
Remarks: [REDACTED]

F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down



- Leakage Type Distress Entry

The final distress category is **Leakage and Deposits**. There are two types of distresses in the **Leakage and Deposits** category; **Leakage** and **Deposits**.

LEAKAGE & DEPOSITS		
River: Structure Name: Downstream City:	Black Rock Channel Black Rock Lock Buffalo	Monolith: 1 Gate: N Location: L
Type: Remarks:	TYPE OF DAMAGES <input checked="" type="checkbox"/> 51 Leakage <input type="checkbox"/> 52 Deposits	
Type: Remarks:	← Location:	Amount:
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

After the distress is selected, the popup for **damage location** appears on the left side of the screen. There are three choices here.

LEAKAGE & DEPOSITS		
R S D	Lock Channel Lock Lock	Monolith: 1 Gate: N Location: L
DAMAGE LOCATION <input checked="" type="checkbox"/> Land Side Face <input type="checkbox"/> River Side Face <input type="checkbox"/> Conduit		Location: ← Amount:
Type: Remarks:	Location:	Amount:
F1 HELP : F10 DONE : ↑ ↓ Menu : ← Previous ; → Next; F2 Up ; F3 Down		

The program then prompts for amount of damage. This is a subjective choice among: **Light**, **Moderate**, or **Heavy**. After selecting amount of damage, the box disappears and the cursor moves to the last field, which again is **remarks**.

LEAKAGE & DEPOSITS		
R S D	AMOUNT OF DAMAGES	Monolith: 1 Gate: N Location: L
	Light Moderate ~ 10 gpm Leakage Heavy	: <input type="text"/> Amount: <input type="text"/>
	Type: <input type="text"/> Location: <input type="text"/> Amount: <input type="text"/> Remarks: <input type="text"/>	
F1 HELP : F10 DONE : <input type="button" value="↑"/> <input type="button" value="↓"/> Menu : <input type="button" value="←"/> Previous ; <input type="button" value="→"/> Next; F2 Up ; F3 Down		

EDITING/DELETING AND VIEWING A DISTRESS

• Path to Main Data Edit

The process of **editing, deleting, or viewing** a distress begins with option 2 of the main menu. First select the river and a structure for the data to be edited. The program display a list of **Inspection Dates**. Select the date to edit.

Structure: Black Rock Lock	River: Black Rock Channel	Project: BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Owner: DAEN NCD
District: NCB	State: NY	City: Buffalo	Chambers: 1
Mile:	Operator: DAEN NCD	Year Complete: 1914	Monolith:
Lock Length:	Lock Width:	Lock Lift:	
1. 625	1. 68	1. 5	
2.	2.	2.	
3.	3.	3.	
4.	4.	4.	
Inspection Dates			
03/63	07/90	10/91	02/92
05/93	11/94		
F1 HELP			F10 DONE

You are then prompted to select the desired monolith.

Structure: Black Rock Lock	River: Black Rock Channel	Project: BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Owner: DAEN NCD
District: NCB	State: NY	City: Buffalo	Chambers: 1
Mile:	Operator: DAEN NCD	Year Complete: 1914	Monolith:
Lock Length:	Lock Width:	Lock Lift:	
1. 625	1. 68	1. 5	
2.	2.	2.	
3.	3.	3.	
4.	4.	4.	
Select Monolith			
1R:RW01	3D:RW02	10:LG04	101:LG04
15R:LW05	121:RW02		
F1: HELP	F2: DELETE MONOLITH		F10: DONE

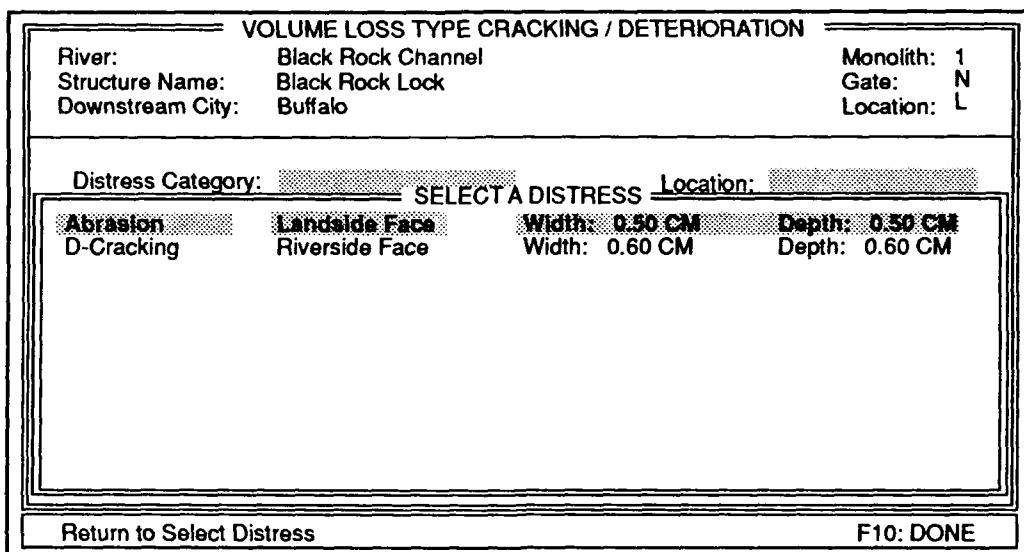
After a brief pause, the next screen appears with a bounce-bar menu across the bottom. This menu allows the user to change the current operating mode. The default is **Edit Data**, but any of the other choices can be made by moving the highlight with an arrow key. Press [RETURN] on the desired option.

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Add Mode			
Select Defect Type:		# of Defects	
No Other Defects			
Cracking	0		
Volume Loss / Deterioration	0		
Steel	0		
Other Damages	0		
Leakage and Deposits	0		
TOTALS	0		
Add Data		Edit Data	
Delete Data		View Data	
		Quit	

Once the mode is established, you may select the defect type.

River:	Black Rock Channel	Monolith:	1
Structure Name:	Black Rock Lock	Gate:	N
Downstream City:	Buffalo	Location:	L
Add Mode			
Select Defect Type:		# of Defects	
No Other Defects			
Cracking	0		
Volume Loss / Deterioration	0		
Steel	0		
Other Damages	0		
Leakage and Deposits	0		
TOTALS	0		
F1 HELP		F10 DONE	

After selecting a defect type (distress), a short pause brings up a large bounce-bar menu within a box labeled **Select a Distress**. Within the box are all the distresses that have been defined for the current monolith (which is identified in the top box). The **distress** in the top row is highlighted. The arrow keys will move the highlight **up** or **down** as desired.



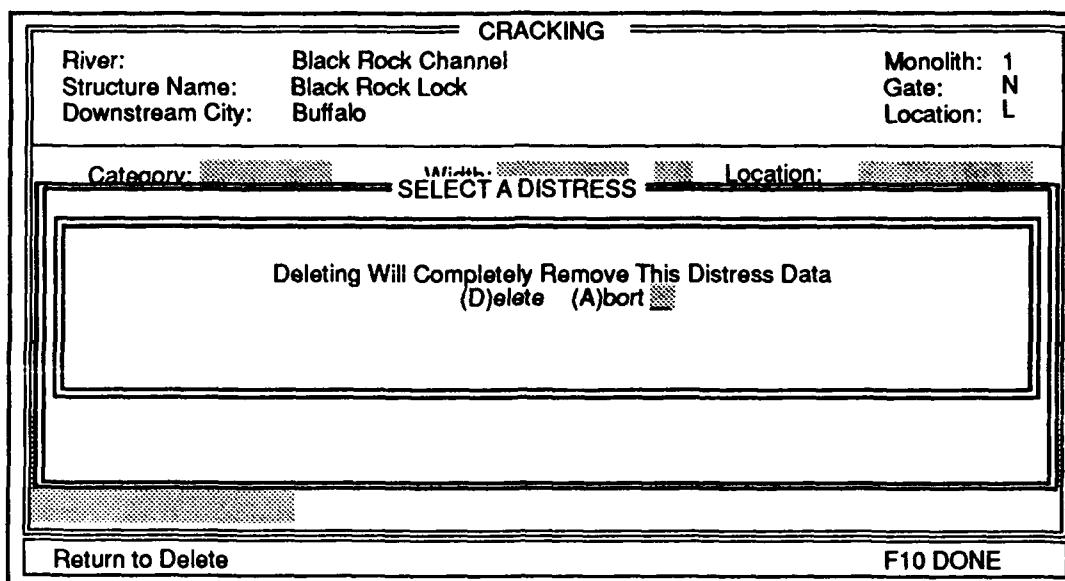
- **Editing**

At this point, you are ready to edit an already defined distress. Simply press **[RETURN]** on the highlighted distress and the data entry screen will appear with the previously entered data next to the field names. You may now step through each field in the same manner as when originally entered. One difference is at the last field, **remarks**. The **[RETURN]** key will not complete this entry. Use **F10** to indicate that you are done editing the screen. When finished, you are returned to the **Select Defect Type** menu where a different defect may be selected.

- **Deleting**

From the **Select Defect Type** menu it is possible to change the current **mode** from **edit** to **add**, **delete**, or **view**. When pressed, the **F10** key will produce a new bounce-bar menu to replace the **23rd line** on the current screen. This one-line menu has the four **mode** options as well as **Quit** to exit the screen entirely. By moving the highlight to the desired option, you may change the current mode and, therefore, the available actions on succeeding screens.

In the delete mode, you are presented with the same list of distress data as in editing. After selecting one, you are asked to confirm the deletion with the prompt shown in the figure below.



By pressing **D**, you confirm the removal of the distress data. The **A** key will back out and not delete anything. Use the **F10** to signal that you are done and the message **Packing....** appears briefly on the screen, assuming you actually did delete some data. The program returns to the **Select Defect Type** menu.

- **Viewing**

View mode is selected the same as the edit and delete modes. Highlight **View Data** in the **mode** menu and press **[RETURN]**. Control returns to the **Select Defect Type** menu. At this time, you may select any of the five defect types. Upon selecting a defect type, a window pops up with all the available records of distress data. Highlight the desired distress record and press **[RETURN]**. The popup window disappears to reveal the same dual-record view screen used in adding and editing distress data. Here the arrow keys may be used to scroll through all of the distress records. The **F10** key will return you to the **Select Defect Type** menu.

Chapter 6

Comments and Life Cycle Cost Analysis

OVERALL MONOLITH COMMENTS

There may be times when you would like to make general comments about an entire monolith, as opposed to documenting specific problems. The feature that allows you to do this is called **Overall Monolith Comments**. This feature allows you to create and edit a document of overall comments for a specific monolith.

After you select **Add Inspection Data**, option 1, on the main menu, you then enter specific inspection data about a monolith (see chapter 5). Once you finish entering data, the following screen appears:

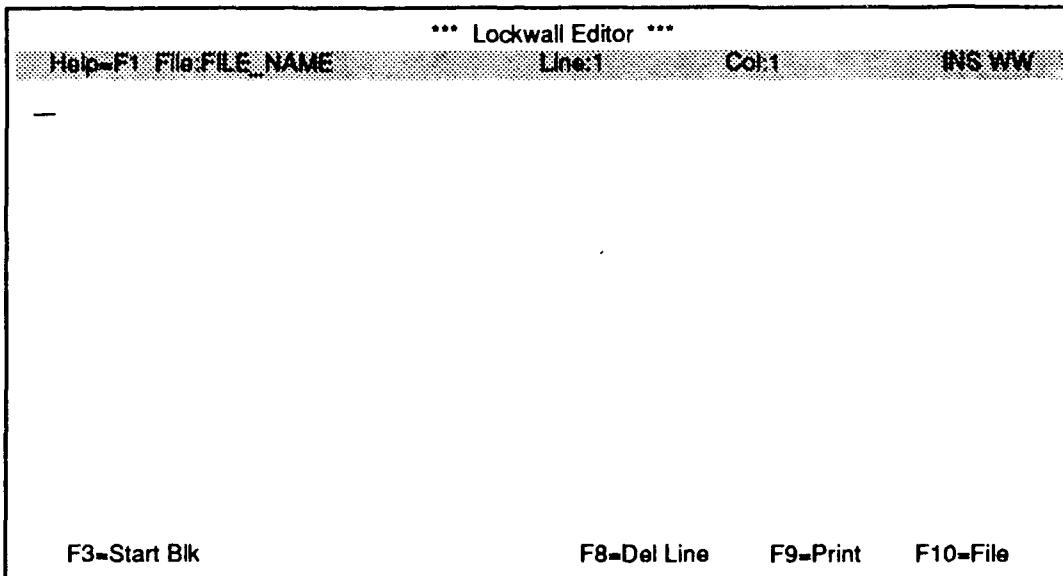
Structure: Black Rock Lock	River: Black Rock Channel	Project: BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Owner: DAEN NCD	Year Complete: 1914
District: NCB	State: NY	City: Buffalo	Chambers: 1	Monolith:
Mile:	Operator: DAEN NCD	Lock Length:	Lock Width:	Lock Lift:
1. 625	1. 68	1.	2.	1. 5
2.	2.	2.	3.	2.
3.	3.	3.	4.	3.
4.	4.	4.		4.

SELECT APPROPRIATE OPTION

[1] Enter Data on This Monolith
[2] Enter Data on Another Monolith
[3] Enter Data on Another Structure
[4] Enter Overall Monolith Comments
[5] Display Condition Index Calculation
[E] Exit - Return to Main Menu

To enter overall or general comments about the monolith that was inspected, select **Enter Overall Monolith Comments**, option 4. The screen will go blank, and the **Lockwall Editor Screen** will appear. You may begin typing your comments in any form you wish. When you type past the end of a line, the text will automatically wrap to the beginning of the next line.

The bottom line of the screen will display the function key options that are available. If you don't know what a certain key does or you need help, press the **F1** function key. When you are finished entering new comments or editing previous comments, press the **F10** function key. To save your new comments, press **F10** again; to abort your new comments, press **F8**.



EDITING EXISTING COMMENTS

You may wish to edit previously entered overall comments about a monolith. To do this, select **Modify/View Inspection Data** from the main menu, then select the desired inspection date, monolith, etc. From the Add/Edit/View/Delete screen select quit. (See chapter 5) The following screen appear.

Structure:	Black Rock Lock	Owner:	DAEN NCD
River:	Black Rock Channel	City:	Buffalo
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR		
District:	NCB	Chambers:	1
State:	NY	Year Complete: 1914	
Mile:		Monolith:	
Operator:	DAEN NCD	Lock Length:	Lock Width:
		1. 625	1. 68
		2.	2.
		3.	3.
		4.	4.
Lock Lift:			
1. 5			
2			
3.			
4.			

SELECT APPROPRIATE OPTION

- [1] Modify / View Data For This Monolith
- [2] Modify / View Data For Another Monolith
- [3] Modify / View Data For Another Date
- [4] Modify / View Data For Another Structure
- [5] Modify / View Data For Another River/Waterway
- [6] Overall Monolith Comments
- [7] Display C.I. for This Monolith
- [E] Exit - Return to Main Menu

Select **Modify/View Overall Monolith Comments**, option 6. This will put you into the **Lockwall Editor Screen**, where you can edit any previous comments for the selected monolith or add new ones.

LIFE CYCLE COST ANALYSIS

The **Life Cycle Cost Analysis (LCCA)** section of the program is accessed from the main menu by option 5. The LCCA section helps to review the costs of concrete lock wall maintenance for a user specified period of time. The LCCA can be performed on monoliths from a specific structure with known defects or for a general case. **Five options** are available from the **LCCA menu**:

- **Create New LCCA**
- **Edit Existing LCCA Information**
- **Delete Existing LCCA**
- **Print Report**
- **Exit - Return to Main Menu**

• **Creating a Life Cycle Cost Analysis**

The **LCCA section** allows you to **create and name** an LCCA and save the LCCA for future editing, report printing, or review. To create a new LCCA, select **option one (1), Create New LCCA** from the LCCA menu. Upon selecting option one (1) you will be asked to select a **River/Waterway** and then a structure.

Once you have selected the **structure**, a list of **inspection dates** for that structure will appear on the screen. If you wish to work with a general case and not use specific **monolith defects** from an inspection, press **F10**. If you wish to **build** an LCCA using known monolith defects, continue on by **highlighting an inspection date** and pressing **[RETURN]**. After selecting an inspection date, the **monoliths** from the inspection date selected will be listed on the screen. The **arrow keys** are used to change the highlighted monolith. To select a **monolith** for LCCA analysis, highlight the monolith and press **[RETURN]**. You may select as many monoliths as you wish. To **unselect** a monolith, **highlight** a selected monolith and press **[RETURN]**.

After selecting monoliths, or if you are preparing a general LCCA with no inspection data, pressing the **F10 key** from the **Inspection Date Selection** screen will cause the **Name LCCA** screen to appear. The **Name LCCA** screen will prompt you to enter a name for your LCCA. This **name** can be up to **10** characters long. Other information you will need to provide is:

1. The year to start the analysis,
2. Number of years to review,
3. The interest rate, and
4. The inflation rate.

After entering the LCCA name information, the **Main LCCA Data Entering** screen will appear:

EDIT AN EXISTING LIFE CYCLE COST ANALYSIS						
Monolith Number	Distress	M&R Alternative	Cost	Rep. Life	Str. Year	Deducts Old New
9L:LW02	D-Cracking	[REDACTED]	0	0	5	5
9L:LW02	Abrasion		0	0	3	3
10L:LW02	Honeycomb		0	0	1	1
10L:LW02	Pattern		0	0	5	5
10L:LW02	Reinforc.		0	0	30	30
10L:LW02	Spalled Joint		0	0	5	5
10L:LW02	Leakage		0	0	5	5
11L:LW02	Vert. & Long.		0	0	30	30
11L:LW02	Pattern		0	0	10	10
11L:LW02	Spalled Joint		0	0	5	5

F1 : Help F2:Delete F3:Calc F5:Re-Select F6:Defaults F10: Done

If you have selected an inspection date and specific monoliths for the LCCA, a list of monoliths and distress noted in the inspection will be preentered for you by the program. The **deduct** value associated with each distress will also be listed. To complete the LCCA analysis, use the **arrow keys** to move the cursor to the **M&R alternative** column, enter a short (20 characters) description of the **repair alternative** you would use to address the listed monolith defect, the estimated **cost** of that repair, and the **life** of the repair.

You also may enter **general maintenance** items that will effect the entire structure. To enter nonmonolith specific items, use the **down arrow key** to move the cursor to the last monolith defect and press the **down arrow key one more time**. This will allow you to enter an additional nonmonolith specific maintenance item. You may enter as many **general maintenance** items as you need.

The **default beginning year** for the analysis has been preentered into the beginning year column for all monolith defects. If you wish to **defer** the maintenance on these items to a later year, you may enter a different year. Changing the year will affect only the **defect** changed.

For the general case, no monolith information will be listed. It is not necessary to add specific monolith information for monolith number or distress. For example, you may wish to simply list an M&R alternative that would affect **all** monoliths in the structure, its **cost**, and the **life expectancy** of the maintenance.

Several function keys are listed along the bottom of the LCCA data entry screen, the following describes their definitions:

F1 (Help) Provides additional information.

F2 (Delete) Deletes the entire highlighted line. You will be prompted for confirmation before the line is deleted.

F3 (Calc) The Calc function will recalculate the monolith distress values listed on the right side of the Create a New LCCA screen and the current LCCA report will be printed. Before beginning the print you will be prompted for printing to the screen or to a printer. Once the print is complete you will be returned to the main LCCA data entry screen.

NOTE: Any repair action listed will completely correct an individual deduct, but not necessarily change the monolith CI by the same amount.

F5 (Reselect) The reselect option allows you to return to the River/Waterway screen and begin developing a new LCCA. Values you have entered into the LCCA you are working on will be saved.

F6 (Defaults) The defaults function allows you to adjust the values provided in the Name LCCA screen. The year to start the analysis, interest rate, inflation rate, and the number of years to analyze can be changed.

F10 (Done) When you have completed entering LCCA information or wish to conclude your current session, press the F10 key and you will be returned to the LCCA Option Menu. Because the LCCA you have been working on will be saved under the name you provided in the Name LCCA section, you can complete part of an LCCA, exit, F10 and return later to add more information.

• **Editing, Deleting, and Printing Existing LCCAs:**

LCCA menu options 2, 3, and 4 share a common screen for selecting your choice. The screen on the next page shows the Edit an LCCA screen. These options also share common keys. The most recent LCCA created and its current default values will always appear on the screen when the Edit, Delete, and Print options are selected.

To select another LCCA, use the down arrow key to step through the list of saved LCCA files, your PC will beep when you have reached the bottom of the list. The up arrow key will allow you to step back up to the top of the list. Pressing F will bring up the first LCCA in the list (most recent), pressing L will bring up the last (oldest) LCCA file. If you wish to quit the operation and return to the LCCA menu, press Q (quit).

Option 2 from the LCCA menu, **Edit Existing LCCA Information** allows you to select a previously named LCCA to review or edit. Upon selecting the edit LCCA option, you will see the **Name LCCA** screen, use the **arrow keys** to step through the LCCA names. When the LCCA name you wish to work with appears in the Name window, press the **F10** function key. The LCCA you selected will then appear in the **Create an LCCA** screen with the information you previously entered. You may **add** new information, **change** existing information, **delete** entire lines, or **change defaults**.

EDIT AN EXISTING LIFE CYCLE COST ANALYSIS							
Monolith Number	Distress	M&R Alternative	Cost	Rep. Life	Str. Year	Deducts Old	Deducts New
9L:LW02	D-Cracking	Repair Deck 9L	5000	10	1995	5	5
9L:LW02	Abrasion		0	0		3	3
10L:LW02	Honeycomb	Patch Honeycomb 10L	20000	25	1990	1	1
10L:LW02	Pattern	Repair Deck 10L	5000	10	1995	5	5
10L:LW02	Reinforc.	10L Honeycomb Patch	0	0		30	30
10L:LW02	Spalled Joint	9L 10L Spalled Joint	10000	25	1990	5	5
10L:LW02	Leakage	9L 10L Spalled Joint	0	0		5	5
11L:LW02	Vert. & Long.	Stitch V&T crack 11L	12000	10	1990	30	30
11L:LW02	Pattern	Repair Deck 11L	5000	10	1995	10	10
11L:LW02	Spalled Joint		0	0		5	5

F1 : Help F2:Delete F3:Calc F5:Re-Select F6:Defaults F10: Done

- **Delete LCCA**

Selecting the **Delete LCCA** option takes you to the **Name LCCA** screen. The **arrow keys** are used to step through the names of the **saved LCCA files**. When the name of the LCCA you wish to **delete** appears in the name window, press the **F5** function key to **delete** the LCCA.

- **Printing an LCCA**

Again, the **print** option will bring up the **Name LCCA** screen. Select the LCCA you wish to **print** and press the **F10** function key. Before beginning printing, the program will ask you if you would like to print to the screen of your PC or to a printer. Enter **S** for the **screen** or **P** for a **printer**.

Chapter 7

Maintenance Activity Records

PICK A RIVER AND A STRUCTURE

After a river and a structure are chosen, a menu appears to Add, Edit, Delete, or Print a Maintenance Activity.

MAINTENANCE ACTIVITY RECORDS	
<ul style="list-style-type: none">[1] Add Maintenance Record[2] Edit Maintenance Record[3] Delete Maintenance Record[4] Print Maintenance Record[E] Exit - Return to Main Menu	
F1 HELP	F10 DONE

Highlight the desired activity and press [RETURN].

ADD A MAINTENANCE ACTIVITY RECORD

ADD MAINTENANCE RECORD	
<p>Activity Title: <input type="text"/></p>	
Date: <input type="text"/> / <input type="text"/> In House / Contract (I/C): <input type="text"/>	<input type="text"/>
Contract No.: <input type="text"/>	
Total Cost: <input type="text"/>	
Labor Cost: <input type="text"/>	Material Cost: <input type="text"/>
In House Labor Hours:	
Crew Type:	<input type="text"/>
(1) <input type="checkbox"/>	<input type="checkbox"/>
(2) <input type="checkbox"/>	<input type="checkbox"/>
(3) <input type="checkbox"/>	<input type="checkbox"/>
(4) <input type="checkbox"/>	<input type="checkbox"/>
Man Hours: <input type="text"/>	
Problem Description: <input type="text"/>	
Activity Description: <input type="text"/>	
F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom	

Enter a title for the Maintenance Activity. The title must be entered for the data to be saved.

Enter a date in the format of MM/YY.

Valid data for In House / Contract is either an I or a C. No other letter or number will be accepted. You must enter one of these letters to proceed with entering data.

Enter dollar amounts for the Total, Labor, and Material costs. If costs include cents, the decimal point must be entered.

In House Labor Hours are entered within a box. Enter the type of crew and the number of man-hours for each crew. Hours can be specified in tenths of an hour, if desired, by entering a decimal point. Any number of labor crews can be entered, although only five crews can be seen at a time when entering data. Press [RETURN] to enter additional crews. Crew types can be scrolled through by using the up and down arrow keys. Press F3 when done entering labor crews.

ADD MAINTENANCE RECORD	
Activity Title:	
Date:	7 In House / Contract (I/C):
Contract No.:	
Total Cost:	
Labor Cost:	Material Cost:
In House Labor Hours: Crew Type:	Man Hours: 0.0
Activity Description:	
F1 HELP : F10 DONE : ← Prev ; → Next; ↑ Up ; ↓ Down ; Home Top ; End Bottom	

For entering a problem description, a large box will appear. Text that is typed in will automatically wrap to the next line. Pressing [RETURN] will complete entry of the problem description and will advance to entry of the activity description. F3 will also do this.

ADD MAINTENANCE RECORD	
Activity Title:	
Problem Description	

Entering an activity description is identical to entering a problem description. However, pressing [RETURN] or F3 will save the record and advance to a new record. Pressing F2 will go back to the problem description.

When done entering Maintenance Activity Records, press F10 to return to the **Maintenance Activity Record** menu.

EDIT A MAINTENANCE ACTIVITY RECORD

Select **Edit** from the menu.

DATE	TITLE	CONTRACT
06/89	Sample Activity Title	Sample Contract Number
08/89	2nd Sample Activity Title	2nd Contract Number

F1 HELP : F10 DONE : <CR> TO Edit:

Use the highlight bar to select a **Maintenance Activity Record** to edit. The date, activity title, and contract number are used to identify the record to edit. The activities listed are in chronological order belonging to the structure and river that were selected.

Press [RETURN] to edit a Maintenance Record.

Use [RETURN], the arrow keys, or F2 and F3 keys to move between the fields.

When the cursor is on the **Activity Title** and the **UP** arrow is pressed, the screen will scroll to the previous record.

When done editing, press **F10**. If you are **NOT** on the **Activity Description** field, you will be prompted to (A)bort, (S)ave, or (C)ontinue editing. Abort will abandon any edits and Save will save all edits. Either action will return to the **Maintenance Activity Record** menu.

Pressing F3 or [RETURN] when editing the **Activity Description** will prompt you to Save Record (Y/N)? After answering, the screen will return to the **Maintenance Activity Record** menu.

DELETE A MAINTENANCE ACTIVITY RECORD

Select **Delete** from the **Maintenance Activity Record** menu.

Records will be listed in the same way as listed for selection for editing. Highlight the record to delete. Press [RETURN] to select the record. This toggles an asterisk to the left of the listed date, marking the record for deletion. Pressing [RETURN] again on the same record will restore the record. You may mark as many records as you wish for deletion.

Press **F10** to exit the selection process. **CAUTION:** After pressing **F10**, records CANNOT BE RESTORED!

To delete **ALL** the **Maintenance Activity Records** for the chosen structure and river, press **F4**. You will be asked if you really want to delete all the records. Responding with N, will abort the deletion process.

A box will pop up to inform you that the chosen records are being deleted and an additional message will appear when deletion is finished.

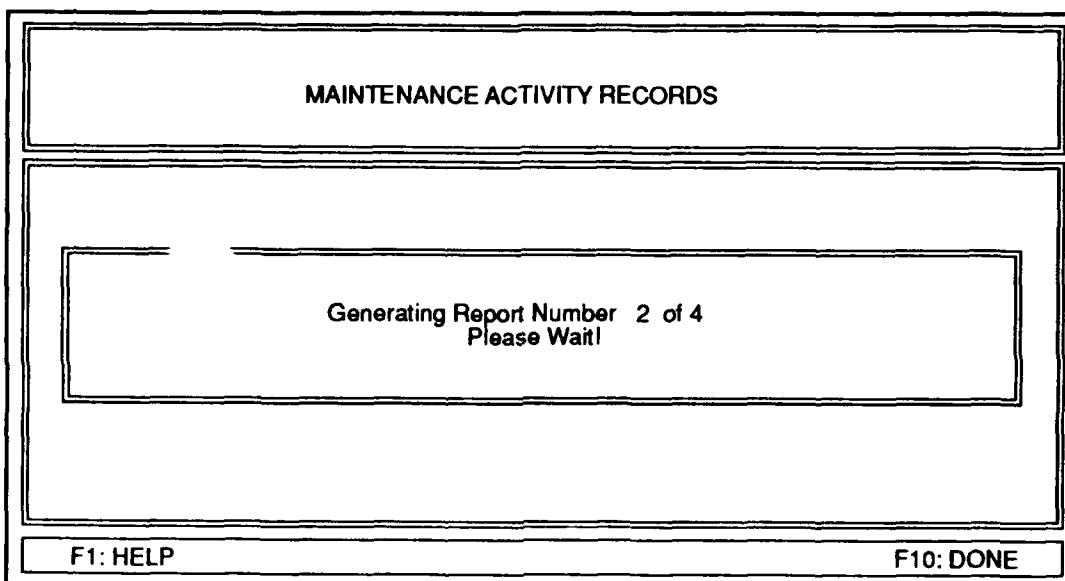
The screen will return to the **Maintenance Activity Record** menu.

PRINT A MAINTENANCE ACTIVITY RECORD

Select Print from the Maintenance Activity Record menu.

Records will be listed in the same way as listed for selection for editing. Highlight the record to print. Press [RETURN] to select the record. This toggles an asterisk to the left of the listed date, marking the record for printing a Maintenance Activity Record report. Pressing [RETURN] again on the same record will prevent the record from being printed. You may mark as many records as you wish for printing.

Press **F4** to print **ALL** of the Maintenance Activity Record reports.



Press **F10** to end the print selection process. If no records were selected, the screen will return to the Maintenance Activity Record menu. Otherwise, a box will pop up to inform you that reports are being generated for the chosen records. When report generation is complete, the screen will return to the Maintenance Activity Record menu.

Chapter 8

Condition Index Calculation and Maintenance & Repair Alternatives

CONDITION INDEX DISPLAY

- Main Menu Access Path**

The Condition Index Display can be accessed from either the **Add Inspection Data**, option 1, or the **Modify/View Inspection Data**, option 2, from the **Main Menu**. Select the appropriate option.

If Add Inspection Data, option 1 on the main menu was chosen, select a river and structure. Enter the data into the Local Structure Inventory Screen. At the Select Defect Type screen, select **No Other Defects**. The mode menu is presented with the following options; Add, Edit, Delete, View, and Quit. Select **Quit**. (See chapter 5 for more detailed information.) The following screen will be displayed.

Structure:	Black Rock Lock	Year Complete:	1914
River:	Black Rock Channel	Monolith:	
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Lock Lift:	
District:	NCB	1. 5	
State:	NY	2.	
Mile:		3.	
Operator:	DAEN NCD	4.	
Lock Length:	Chambers: 1	Lock Width:	
1. 625	1. 68	2.	
2.		3.	
3.		4.	
4.			

SELECT APPROPRIATE OPTION

[1] Enter Data on This Monolith
[2] Enter Data on Another Monolith
[3] Enter Data on Another Structure
[4] Enter Overall Monolith Comments
[5] Display Condition Index Calculation
[E] Exit - Return to Main Menu

Select the appropriate option to view the Condition Index on the selected monolith (monolith number indicated in upper right corner of screen), press **option 5** on the menu.

If Modify / View Inspection Data, option 2 on the main menu is chosen, select a river, structure, inspection date, and monolith number. At the Select Defect Type screen, select **No Other Defects**. The mode menu is presented with the following options; Add, Edit, Delete, View, and

Quit. Select Quit. (See chapter 5 for more detailed information.) Select the appropriate option to view the Condition Index on the selected monolith (monolith number indicated in the upper right corner of screen), press option 7 on the menu.

• Deduct Value and Condition Index Display

Structure:	Black Rock Lock	Year Complete:	1914
River:	Black Rock Channel	Monolith:	
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Lock Lift:	
District:	NCB	1. 5	
State:	NY	2.	
Mile:		3.	
Operator:	DAEN NCD	4.	
Lock Length:	Chambers: 1		
1. 625	Lock Width:		
2.	1. 68		
3.	2.		
4.	3.		
	4.		
<u>Deduct Value & Condition Index</u>			
Deduct Value = 30		Condition Index = 70	
Press Any Key to See Distresses			

The above screen shows the Condition Index and Deduct Value of the monolith. To view the distresses that contributed to the Condition Index, press any key.

• Distress Contribution Display

Structure:	Black Rock Lock	Year Complete:	1914
River:	Black Rock Channel	Monolith:	
Project:	BLACK ROCK CHANNEL AND TONAWANDA HARBOR	Lock Lift:	
District:	NCB	1. 5	
State:	NY	2.	
Mile:		3.	
Operator:	DAEN NCD	4.	
Lock Length:	Chambers: 1		
1. 625	Lock Width:		
2.	1. 68		
3.	2.		
4.	3.		
	4.		
<u>Distress</u>	<u>Distress Location of Land Wall</u>	<u>Deduct</u>	
>Checking	Landside Face	20	
>D-Cracking	Riverside Face	10	
> Contributed to CI G Gate Block Add + Adds to a Max of 20			

This screen indicates all distresses present on the monolith and indicates which distresses contributed to the Condition Index. At the bottom of the screen, the symbol key displays the

symbols and their meanings. These symbols may appear next to a particular distress in the Distress Type column.

Note: There are four divisions of data that contribute to the condition index, division A, B, C, and D. Division A examines Cracking, Volumetric Cracking, and Steel type distresses. Only the highest value is actually used in the calculation. Division B are the additional deductions applied if the monolith is a gate block. Division C examines Other and Leakage & Deposit type distresses. In Division C there is a maximum deduct value of 20. Division D determines the deduction applied if the distress is on the deck of the monolith. (See Technical Report REMR-OM-4 and the Lock Monolith Condition Index Calculation Form in Appendix B).

- > **Contributes to the CI calculation.** This symbol indicates that the particular distress reduces the final value of the condition index according to the formula discussed in the Technical Report REMR-OM-4 "A Rating System for the Concrete in Navigation Lock Monoliths."
- G **Gate Block Add.** If the monolith is a gate block there is an additional deduction when calculating the condition index. This is Division B on the Lock Monolith Condition Index Calculation Form. The symbol indicates which distress is used in the Division B deduction.
- + **Adds to a Max of 20.** Division C has a maximum value of 20. All the distresses marked with a + are used in the calculation. The deduct values for these distresses are summed. If the sum is greater than 20 it is rounded to 20.
- S **Data Is Suspect.** Data for a distress was entered that was incomplete. Insufficient data was entered to allow the calculation of a Deduct Value for final determination of a condition Index.

Press **F10** when done.

MAINTENANCE AND REPAIR ALTERNATIVES

A wealth of information regarding maintenance and repair operations for concrete lock walls has been gathered and stored in the LOCKWALL program. The information exists in the form of American Standard Code for Information Interchange (ASCII) files. These ASCII files can be sent to the microcomputer monitor for viewing or to the printer for a hard copy. The primary sources of information contained in these ASCII files were ACI Manual of Concrete Practice Parts I-V 1987; Bullock 1989; Headquarters, US Army Corps of Engineers 1986; and McDonald 1987. Much of the text from these references is repeated directly by the LOCKWALL program.

The files are sorted into three groups: **Terms & Definitions**, **Distress: Symptoms & Causes**, and **Lockwall Rehabilitation: Techniques & Alternatives**. The files serve as a library to help you research and determine proper maintenance strategies for a given set of distresses.

Terms & Definitions. This collection of files provides definitions of distress and other terms commonly associated with concrete, and maintenance and repair of concrete structures. Specific distresses are addressed and a glossary of concrete terminology is supplied.

Distress: Symptoms & Causes. Before deciding on the repair procedure for distress in concrete, the cause of the distress must first be determined. This group of files leads you through the process of correctly relating distress symptoms to the actual cause of the distress. The files include information on accidental loadings, chemical reactions, construction errors, corrosion of embedded metals, design errors, erosion, freezing and thawing, settlement and movement, shrinkage, temperature changes, and weathering.

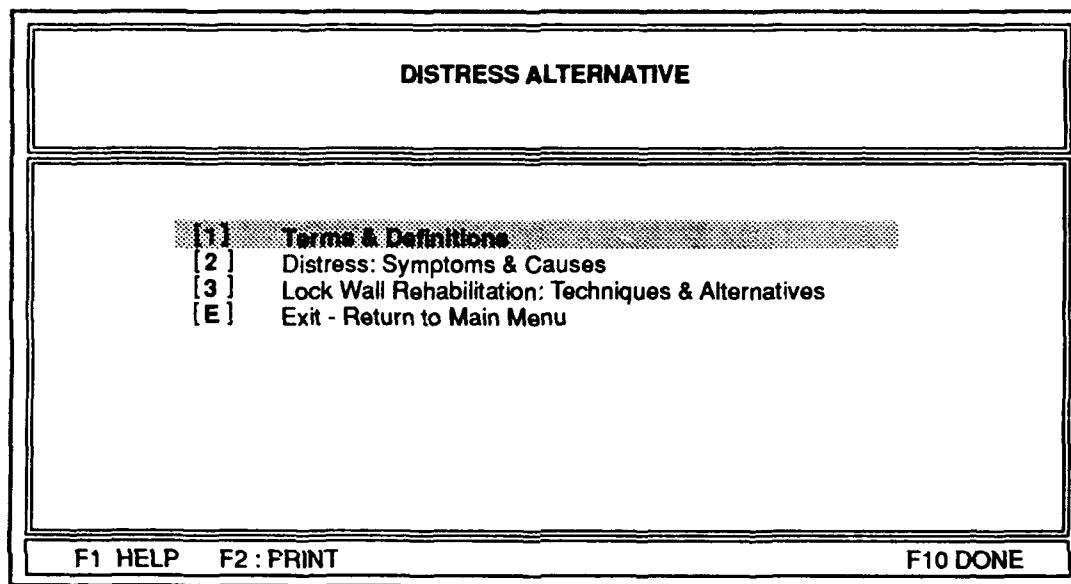
Lockwall Rehabilitation Techniques & Alternatives. Once the cause of the distress is identified, a repair plan can be formulated. A decisionmaking process is identified and discussed. The process takes into account the distress type and cause and, through a decision tree, narrows down the number of feasible repair alternatives.

The files collected in this section discuss in detail such subjects as concrete removal and preparation for repair, proper selection of materials according to specific distress types, and proper selection of repair methods. Repair methods discussed include conventional concrete placement, epoxy injections, grouting, overlays, precast stay-in-place forming, preplaced aggregate concrete, routing and sealing, shotcrete, and stitching. Other topics include concrete maintenance, surface coatings, joint maintenance, and water stop failures.

The files do not interact with the CI data base in any way. They are in place strictly for informational purposes.

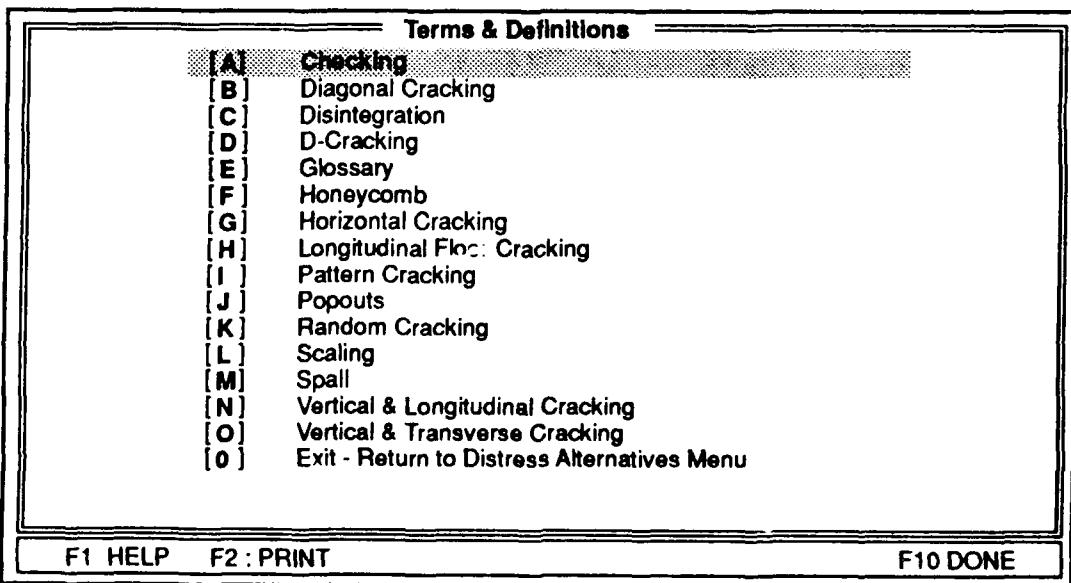
To access the Maintenance and Repair Alternatives menu, press option 4 on the Main Menu. The Distress Alternatives menu is displayed.

NOTE: In this area, there is the capability to print material available within the menu options. The following is an explanation of the three options listed in the menu.



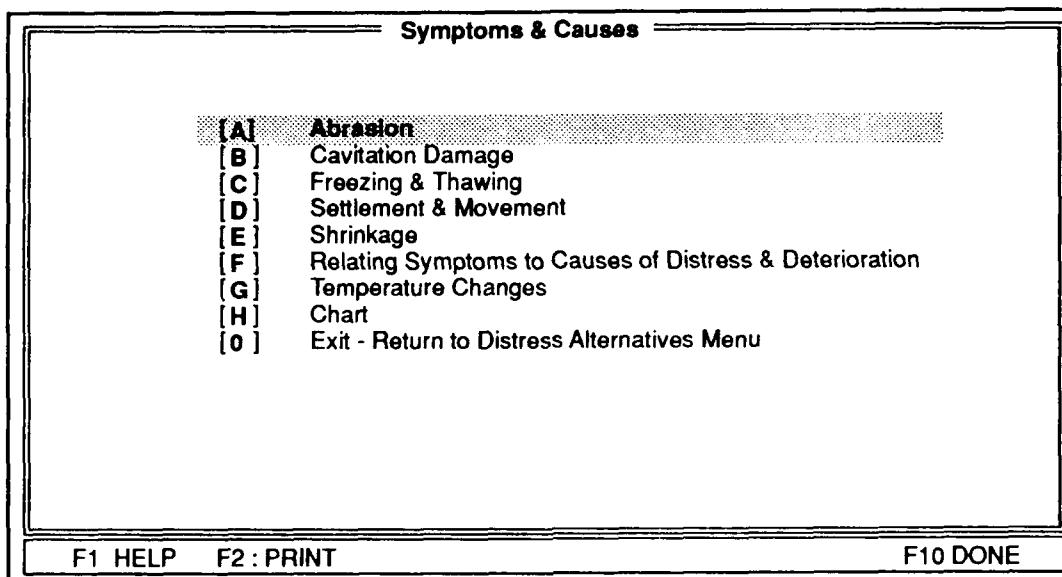
Terms and Definitions, option 1:

Defines the particular terms associated with distress types. Highlight a term and press [RETURN]. The definition is displayed. Use the arrow keys to scroll through the text. Printouts of the material are available by pressing F2.



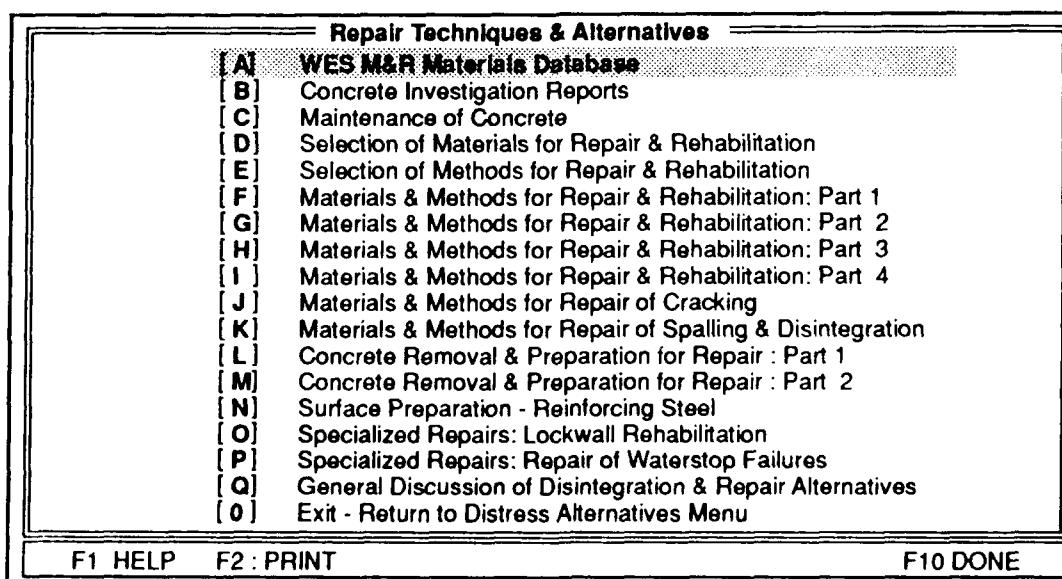
Distress: Symptoms and Causes, option 2:

This section gives an explanation of the causes and symptoms related to distress. Highlight a term and press [RETURN]. An explanation of the causes and symptoms, related to that term, are displayed. Use the **arrow keys** to scroll through the text. Printouts of the material are available by pressing **F2**.



Lock Wall Rehabilitation: Techniques and Alternatives, option 3:

This section provides access to information on repair techniques and alternatives. Highlight a topic and press [RETURN]. Information on that topic is displayed. Use the arrow keys to scroll through the text. Printouts of the material are available by pressing **F2**.



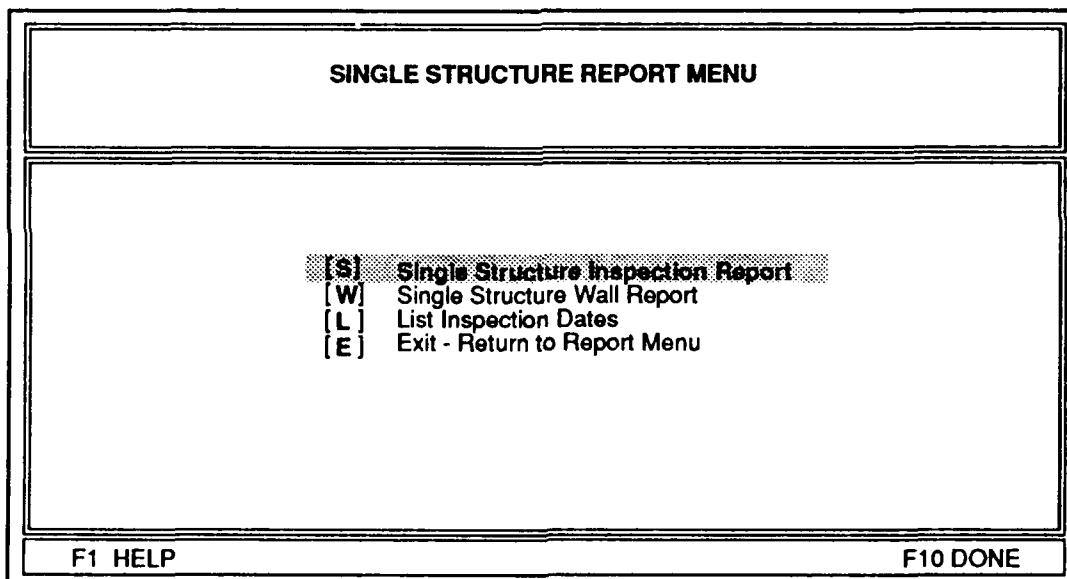
Chapter 9

Reports and Forms

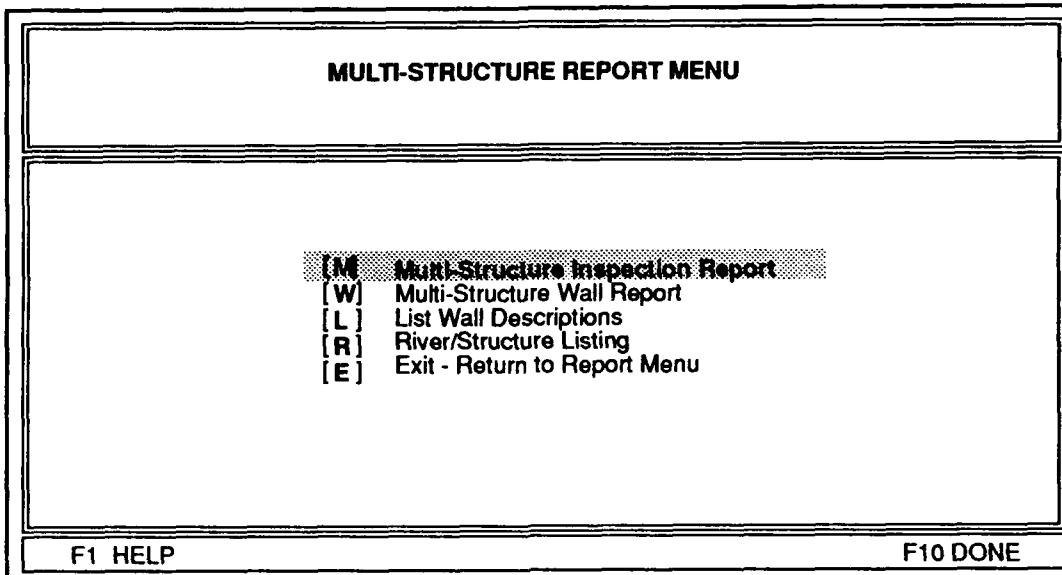
REPORTS

To access the **Report Menu**, press option 6 on the **Main Menu**. In this section, different types of reports are generated for single structures and multi-structures. The following is an explanation of the **three options** listed in the **Report Menu**.

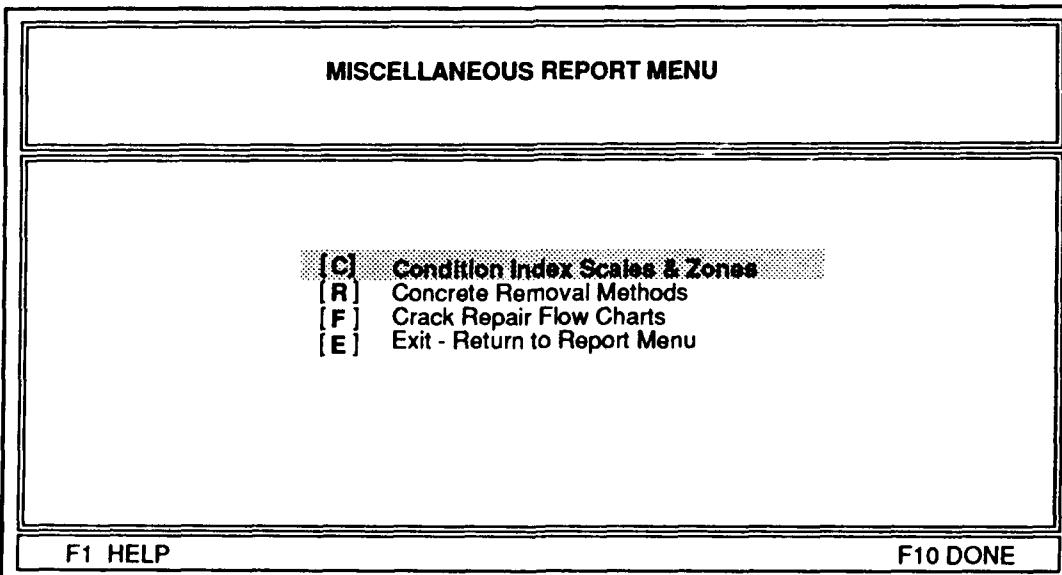
Single Structure Reports, option 1. When this option is selected, the **Single Structure Report** menu is displayed. **Three reports/lists** are available:



Multi-Structure Reports, option 2. In selecting this option, a menu is displayed that has four options listed. Four reports/lists are available:



Condition Index Scale/Zones, option 3. This option generates a text file that can be printed out. It generates two fixed tables: the **Condition Index Scale** which gives the scale value ranges and condition descriptions of each range; and the **Condition Index Zones** which lists the three zones, their respective CI ranges, and what action should be taken in each zone.



Report River/Structure Selection is used for all single structure reports and all multi-structure reports, except **River/Structure Listing**.

Report River / Structure Selection	
Single Structure Inspection Report	
River / Structure	District
Black Rock Channel	NCB
BLACK ROCK LOCK	NCB
Calumet River	NCR
THOMAS J. O'BRIEN LOCK AND DAM	NCR
Chicago Sanitary and Ship Canal	NCR
LOCKPORT LOCK	NCR
Fox River	NCE
APPLETON FIRST LOCK (UPPER DAM)	NCE
APPLETON FOURTH LOCK (LOWER DAM)	NCE
APPLETON SECOND LOCK	NCE

Space-Bar toggles Selection
Cursor-Keys move Selector

F1 HELP F2: All F3: Prev Riv F4: Next Riv F5: District F10 DONE

F2 is used for selection of all structures or none. Use the cursor keys to move around the list and the space bar to select or deselect structures individually. **F5** selects or deselects structures in an indicated district. **F3** moves to the previous river; **F4** moves to the next river. Through **F1**, help is available. **F10** tells the system you are through with the selection.

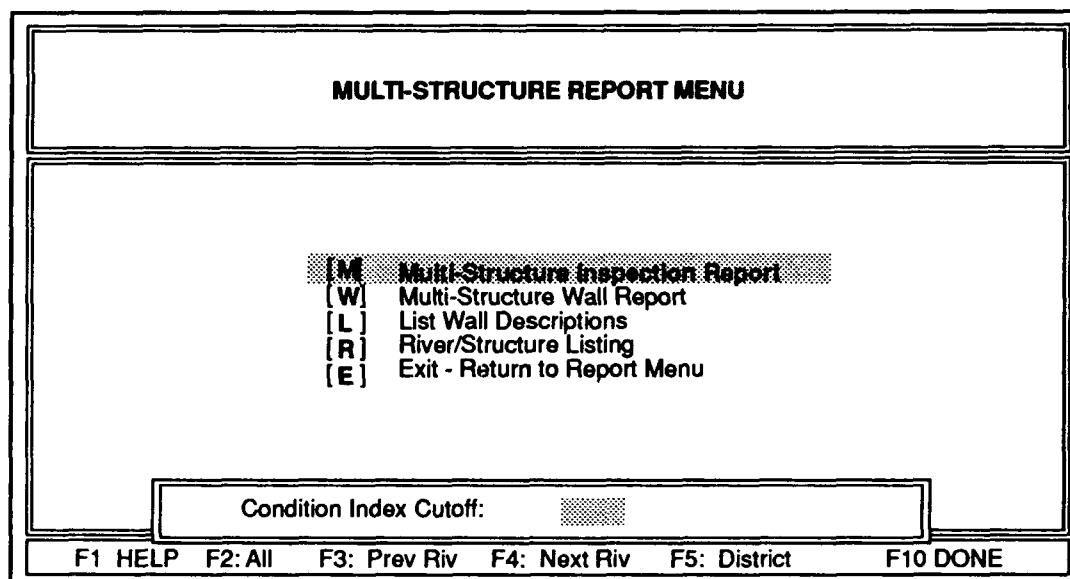
SINGLE STRUCTURE REPORT MENU	
Single Structure Report Options	
Detailed Distress Information	
Lock Structure Inventory	
Individual Monolith CIs	
Overall Monolith Comments	
Inspection Team Listing	
Condition Index Graph	
Latest Inspection From	to

F1 HELP F2 REPORT F10 DONE

The previous page (bottom) shows the **Single Structure Inspection Report** menu screen. Work through the options **Y** for the ones you want, **N** for those you do not want. The last option allows you to enter inspection date range.

NOTE:

Only the latest inspection data in the date range entered will appear on the report (except for values on the CI graph).



A Condition Index Cutoff Value from 0 to 100 is centered for the **Multi-Structure Inspection and Wall Reports**. Only monoliths on walls with CI values equal to or less than the cutoff value will appear on the reports.

Report River Selection	
River / Structure Listing	
River	District
Black Rock Channel	NCR
Calumet River	NCR
Chicago Sanitary and Ship Canal	NCR
Fox River	NCE
Illinois River	NCR
Inland Route	NCE
Mississippi River	NCS
Sandy River	NCS
South St. Mary's River	NCE
St. Mary's River	NCE

Space-Bar toggles Selection
Cursor-Keys move Selector

F1 HELP F2: All F5: District F10 DONE

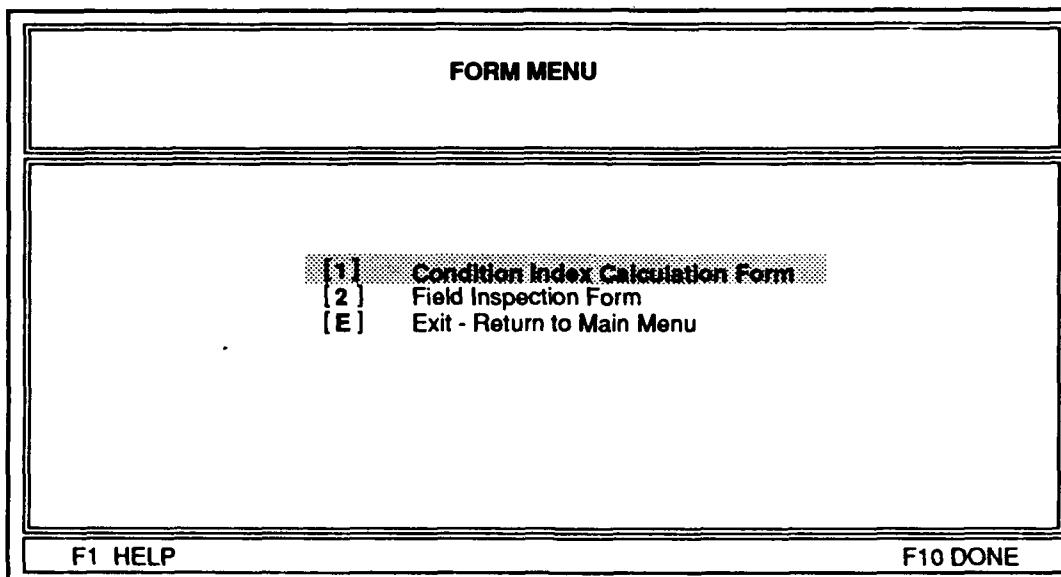
The **River/Structure Listing** report only requires the selection of rivers to appear on the report. Use of this screen is similar to that of the **Report River/Structure Selection** screen. The **F1** help screen will help you review the process.

REPORT PRINTOUTS

Note: Keep in mind that the program has a **machine configuration** process that includes defining the printer to be used. If the proper printer has not been defined through this process it is possible to get **unwanted ASCII characters** on many of the reports. Make sure that the printer used for reports is the same as the one identified in **Machine Configuration** from the main menu.

See Appendix A for sample reports.

FORMS



The **Form** menu is accessed from the **Main Menu** by pressing **7**. The Form section offers the capability to print out two forms: the Condition Index Calculation Form and the Field Inspection Form. Highlight the appropriate form and press [**RETURN**]. Enter the number of copies needed and press [**RETURN**].

Appendix A

Single Structure Inspection Report

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #1R:UG04

Gate Block? NO

CRACKING	LOCATION	WIDTH	DV	
No cracking distress for this monolith.				
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
Spalling	Land Side	10.00 %	0.21 %	*
EXPOSED STEEL	LOCATION	AMOUNT	DV	
None for this monolith.				
CONDUITS	LOCATION	DEPTH	DV	
No conduit distress for this monolith.				
OTHER	LOCATION	AMOUNT	DV	
None for this monolith.				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
No leakage or deposit distress for this monolith.				
DECKS	LOCATION	AMOUNT	DV	
Pattern		Over 25 %	10	

TOTAL DEDUCT = 10

CONDITION INDEX = 90

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #1R:UG04.1 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #2R:RW05	Gate Block? YES	River Wall
-------------------	-----------------	------------

CRACKING	LOCATION	WIDTH	DV
----------	----------	-------	----

No cracking distress for this monolith.

VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
---------------------	----------	--------	--------	----

No volumetric cracking distress for this monolith.

EXPOSED STEEL	LOCATION	AMOUNT	DV
---------------	----------	--------	----

None for this monolith.

CONDUITS	DEPTH	DV
----------	-------	----

No conduit distress for this monolith.

OTHER	LOCATION	AMOUNT	DV
-------	----------	--------	----

None for this monolith.

LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV
--------------------	----------	--------	----

No leakage or deposit distress for this monolith.

DECKS	AMOUNT	DV
-------	--------	----

Pattern	Under 25 %	5
---------	------------	---

GATE BLOCK DEDUCT = NONE

TOTAL DEDUCT = 5

CONDITION INDEX = 95

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are
 treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #2R:RW05.1 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #4L:UG01	Gate Block? NO
-------------------	----------------

CRACKING	LOCATION	WIDTH	DV
----------	----------	-------	----

No cracking distress for this monolith.			
---	--	--	--

VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
---------------------	----------	--------	--------	----

Abrasion	River Side	100.0 %	1.39 %	7
----------	------------	---------	--------	---

Comments: Abrasion near top of riverside bull nose.
Appears minor.

EXPOSED STEEL	LOCATION	AMOUNT	DV
---------------	----------	--------	----

None for this monolith.			
-------------------------	--	--	--

CONDUITS		DEPTH	DV
----------	--	-------	----

No conduit distress for this monolith.			
--	--	--	--

OTHER	LOCATION	AMOUNT	DV
-------	----------	--------	----

None for this monolith.			
-------------------------	--	--	--

LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV
--------------------	----------	--------	----

No leakage or deposit distress for this monolith.			
---	--	--	--

DECKS		AMOUNT	DV
-------	--	--------	----

No deck distress for this monolith.			
-------------------------------------	--	--	--

TOTAL DEDUCT = 7

CONDITION INDEX = 93

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #4L:UG01.1 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #9L:LW02	Gate Block? YES	Land Wall		
CRACKING	LOCATION	WIDTH	DV	
<u>No cracking distress for this monolith.</u>				
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
Abrasions River Side 100.0 % 0.56 % 3 Comments: 4' tall, along top of wall				
EXPOSED STEEL	LOCATION	AMOUNT	DV	
<u>None for this monolith.</u>				
CONDUITS		DEPTH	DV	
<u>No conduit distress for this monolith.</u>				
OTHER	LOCATION	AMOUNT	DV	
<u>None for this monolith.</u>				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
<u>No leakage or deposit distress for this monolith.</u>				
DECKS		AMOUNT	DV	
D-Cracking		Under 25 %	5	
Comments: very light, at corners				

GATE BLOCK DEDUCT = 3

TOTAL DEDUCT = 11

CONDITION INDEX = 89

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #9L:LW02.1 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #10L:LW02 Gate Block? NO Land Wall

CRACKING	LOCATION	WIDTH	DV
----------	----------	-------	----

No cracking distress for this monolith.

VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
---------------------	----------	--------	--------	----

Honeycomb River Side 6.67 % 1.67 % *
Comments: 28' below deck, shows exposed re-bars, el
500', 36"x8"x5"

Abrasion River Side 100.0 % 0.33 % *
Comments: actual monolith thickness is 41', used 25'
to account for culvert valve pit.

EXPOSED STEEL	LOCATION	AMOUNT	DV
---------------	----------	--------	----

Reinforc. River Side Under 50% 30

CONDUITS	DEPTH	DV
----------	-------	----

No conduit distress for this monolith.

OTHER	LOCATION	AMOUNT	DV
-------	----------	--------	----

Spalled Joint River Side Light 5 +
Comments: upstream joint, 10' below deck, 2'x2'x1'

LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV
--------------------	----------	--------	----

Leakage River Side Light 5 +
Comments: water leaks at spalled joint

DECKS	AMOUNT	DV
-------	--------	----

Pattern Under 25 % 5

KEY: * - This distress ignored in C.I. calculation.
+ - These distresses add to a maximum deduct of 20.
? - This distress has missing data.
Rn - Distresses tagged with Rn are related, and are
treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #10L:LW02.1 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #19 (NCR)

Monolith #10L:LW02

Gate Block? NO

Land Wall

TOTAL DEDUCT = 45

CONDITION INDEX = 55

KEY: * - This distress ignored in C.I. calculation.
+ - These distresses add to a maximum deduct of 20.
? - This distress has missing data.
Rn - Distresses tagged with Rn are related, and are
treated as a single distress with a single D.V.

Inspection Date: 04/89 Monolith #10L:LW02.2 Report: 15-MAY-1990

SINGLE STRUCTURE REPORT

Mississippi River
MISSISSIPPI RIVER LOCK AND DAM #19

05/15/90

Downstream City: WARSAW, ILLINOIS
Owner: CENCR & UNION ELECT POWER CO
Operator: CENCR
Completed: 1957
Project: PN
Number of Chambers: 1

State: IA

Length	Width	Lift
1200	110	38

Individual Monolith Condition Indices

Monolith	Condition Index
1R:UG04	90
2R:RW05	95
4L:UG01	93
9L:LW02	89
10L:LW02	55

Inspection Team

Name: Fred Joers
Office: CENCR-ED-DS
Title: Structural Engineer (309)-788-6361

Name: Wen Tsau
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Name: Dave McKay
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Name: Tony Kao
Office: CECER-EM
Title: Civil Engineer, P.E. (217)-373-7238

Name: Jim Stecker
Office: CECER-EM, IPA
Title: Civil Engineer (515)-232-4638

Overall Monolith Comments

None for Monolith # 1

None for Monolith # 2

None for Monolith # 4

None for Monolith # 9

Overall Monolith Comments

None for Monolith # 10

Single Structure Wall Report

WALL CONDITION INDEX LISTING

Mississippi River

05/17/90

MISSISSIPPI RIVER LOCK AND DAM #19

Upper Guide Wall

LS

1L:UG01	100	2L:UG01	Unk	3L:UG01	Unk	4L:UG01	93
5L:UG01	Unk	6L:UG01	Unk	7L:UG01	Unk	8L:UG01	Unk
1U:UG01	Unk						

Total Monoliths: 10 Average Wall CI: 97 Lowest Wall CI: 93

Main Chamber Land Wall

9L:LW02	89	10L:LW02	55	11L:LW02	55	12L:LW02	Unk
13L:LW02	Unk	14L:LW02	Unk	15L:LW02	Unk	16L:LW02	Unk
17L:LW02	Unk	18L:LW02	Unk	19L:LW02	Unk	20L:LW02	Unk
21L:LW02	Unk	22L:LW02	Unk	23L:LW02	Unk	24L:LW02	Unk
25L:LW02	Unk	26L:LW02	Unk	27L:LW02	95	28L:LW02	Unk
29L:LW02	Unk	30L:LW02	85	31L:LW02	Unk	32L:LW02	Unk
33L:LW02	Unk	34L:LW02	Unk	35L:LW02	Unk	36L:LW02	Unk
37L:LW02	Unk	38L:LW02	Unk	39L:LW02	Unk	40L:LW02	Unk
41L:LW02	Unk	42L:LW02	Unk	43L:LW02	Unk	44L:LW02	Unk
45L:LW02	Unk	46L:LW02	Unk	47L:LW02	Unk	48L:LW02	100
49L:LW02	50						

Total Monoliths: 42 Average Wall CI: 76 Lowest Wall CI: 50

Lower Guide Wall

LS

50L:LG03	Unk	51L:LG03	Unk	52L:LG03	100	53L:LG03	Unk
54L:LG03	Unk	55L:LG03	Unk	56L:LG03	Unk	57L:LG03	Unk
58L:LG03	Unk	59L:LG03	Unk	60L:LG03	Unk	61L:LG03	Unk
62L:LG03	Unk	63L:LG03	Unk	64L:LG03	Unk	65L:LG03	Unk
66L:LG03	Unk	67L:LG03	Unk				

Total Monoliths: 19 Average Wall CI: 100 Lowest Wall CI: 100

Wall Condition Index Listing Continued...

Upper Guide Wall

RS

1R:UG04 90

Total Monoliths: 2 Average Wall CI: 90 Lowest Wall CI: 90

Main Chamber River Wall

2R:RW05	95	3R:RW05	Unk	4R:RW05	Unk	5R:RW05	Unk
6R:RW05	Unk	7R:RW05	Unk	8R:RW05	Unk	9R:RW05	Unk
10R:RW05	Unk	11R:RW05	Unk	12R:RW05	100	13R:RW05	Unk
14R:RW05	Unk	15R:RW05	Unk	16R:RW05	Unk	17R:RW05	Unk
18R:RW05	Unk	19R:RW05	Unk	20R:RW05	Unk	21R:RW05	Unk
22R:RW05	94	23R:RW05	Unk	24R:RW05	Unk	25R:RW05	Unk
26R:RW05	Unk	27R:RW05	Unk	28R:RW05	Unk	29R:RW05	Unk
30R:RW05	Unk	31R:RW05	Unk	32R:RW05	Unk	33R:RW05	Unk
34R:RW05	Unk	35R:RW05	Unk	36R:RW05	Unk	37R:RW05	Unk
38R:RW05	80	39R:RW05	Unk	40R:RW05	95	41R:RW05	65

Total Monoliths: 40 Average Wall CI: 88 Lowest Wall CI: 65

Lower Guide Wall

RS

42R:LG06	Unk	43R:LG06	89	44R:LG06	Unk	45R:LG06	Unk
46R:LG06	Unk	47R:LG06	70	48R:LG06	Unk	49R:LG06	Unk
50R:LG06	Jnk	51R:LG06	Unk				

Total Monoliths: 11 Average Wall CI: 80 Lowest Wall CI: 70

Wall Condition Index Summary

Wall Type	Wall ID	Number of Monoliths	Wall CI (Average)	Wall CI (Lowest)
Upper Guide Wall	LS	10	97	93
Main Chamber Land Wall		42	76	50
Lower Guide Wall	LS	19	100	100

Wall Definition Listing Continued...

Wall Type	Wall ID	Number of Monoliths	Wall CI (Average)	Wall CI (Lowest)
Upper Guide Wall	RS	2	90	90
Main Chamber River Wall		40	88	65
Lower Guide Wall	RS	11	80	70

List Inspection Dates

Inspection Date Summary

Black Rock Channel

BLACK ROCK LOCK

JAN 89
APR 89

MAY 90
JUN 89

DEC 89

Multi-Structure Inspection Report

MULTIPLE STRUCTURE REPORT #1: BLACK ROCK LOCK (NCB)

Monolith #1:LW01

Gate Block? NO

CRACKING	LOCATION	WIDTH	DV	
Horizontal	Land Side	0.500 IN	40	
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
Abrasion	Land Side	0.50 %	0.50 %	*
D-Cracking	River Side	0.60 %	0.60 %	*
EXPOSED STEEL	LOCATION	AMOUNT	DV	
None for this monolith.				
CONDUITS	LOCATION	DEPTH	DV	
No conduit distress for this monolith.				
OTHER	LOCATION	AMOUNT	DV	
None for this monolith.				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
No leakage or deposit distress for this monolith.				
DECKS	LOCATION	AMOUNT	DV	
No deck distress for this monolith.				

TOTAL DEDUCT = 40

CONDITION INDEX = 60

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 05/90 Monolith #1:LW01.1 Report: 15-MAY-1990

MULTIPLE STRUCTURE REPORT #1: BLACK ROCK LOCK (NCB)

Monolith #1:LW01	Gate Block? NO		
CRACKING	LOCATION	WIDTH	DV
Horizontal	River Side	0.001 IN	10
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH
No volumetric cracking distress for this monolith.			
EXPOSED STEEL	LOCATION	AMOUNT	DV
None for this monolith.			
CONDUITS		DEPTH	DV
No conduit distress for this monolith.			
OTHER	LOCATION	AMOUNT	DV
None for this monolith.			
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV
No leakage or deposit distress for this monolith.			
DECKS		AMOUNT	DV
No deck distress for this monolith.			
			TOTAL DEDUCT = 10
			CONDITION INDEX = 90

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 06/89 Monolith #1:LW01.1 Report: 15-MAY-1990

MULTIPLE STRUCTURE REPORT #1: BLACK ROCK LOCK (NCB)

Monolith #5:LW01 Gate Block? NO

CRACKING	LOCATION	WIDTH	DV	
No cracking distress for this monolith.				
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
Pattern	Land Side	0.01 %	0.01 %	*
EXPOSED STEEL	LOCATION	AMOUNT	DV	
None for this monolith.				
CONDUITS	LOCATION	DEPTH	DV	
No conduit distress for this monolith.				
OTHER	LOCATION	AMOUNT	DV	
None for this monolith.				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
No leakage or deposit distress for this monolith.				
DECKS	LOCATION	AMOUNT	DV	
No deck distress for this monolith.				

TOTAL DEDUCT = 0

CONDITION INDEX = 100

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 05/90 Monolith #5:LW01.1 Report: 15-MAY-1990

MULTIPLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #01 (NCS)

Monolith #1:GR01

Gate Block? NO

CRACKING	LOCATION	WIDTH	DV	
Horizontal	Land Side	1.000 IN	40	
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
No volumetric cracking distress for this monolith.				
EXPOSED STEEL	LOCATION	AMOUNT	DV	
None for this monolith.				
CONDUITS		DEPTH	DV	
No conduit distress for this monolith.				
OTHER	LOCATION	AMOUNT	DV	
None for this monolith.				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
No leakage or deposit distress for this monolith.				
DECKS		AMOUNT	DV	
No deck distress for this monolith.				

TOTAL DEDUCT = 40

CONDITION INDEX = 60

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 01/89 Monolith #1:GR01.1 Report: 15-MAY-1990

MULTIPLE STRUCTURE REPORT #1: MISSISSIPPI RIVER LOCK AND DAM #01 (NCS)

Monolith #10:GR01

Gate Block? NO

CRACKING	LOCATION	WIDTH	DV	
Horizontal	Land Side	1.000 IN	40	
VOLUMETRIC CRACKING	LOCATION	%WIDTH	%DEPTH	DV
No volumetric cracking distress for this monolith.				
EXPOSED STEEL	LOCATION	AMOUNT	DV	
None for this monolith.				
CONDUITS		DEPTH	DV	
No conduit distress for this monolith.				
OTHER	LOCATION	AMOUNT	DV	
None for this monolith.				
LEAKAGE & DEPOSITS	LOCATION	AMOUNT	DV	
No leakage or deposit distress for this monolith.				
DECKS		AMOUNT	DV	
No deck distress for this monolith.				

TOTAL DEDUCT = 40

CONDITION INDEX = 60

KEY: * - This distress ignored in C.I. calculation.
 + - These distresses add to a maximum deduct of 20.
 ? - This distress has missing data.
 Rn - Distresses tagged with Rn are related, and are treated as a single distress with a single D.V.

Inspection Date: 01/89 Monolith #10:GR01.1 Report: 15-MAY-1990

Multi-Structure Wall Report

SELECTIVE WALL CONDITION INDEX REPORT

Black Rock Channel

05/15/90

Condition Index Cutoff: 100

BLACK ROCK LOCK

Main Chamber Land Wall

LW01

Total Monoliths: 6 Average Wall CI: 100 Lowest Wall CI: 100

SELECTIVE WALL CONDITION INDEX REPORT

Calumet River

05/15/90

Condition Index Cutoff: 100

THOMAS J. O'BRIEN LOCK AND DAM

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

Chicago Sanitary and Ship Canal

05/15/90

Condition Index Cutoff: 100

LOCKPORT LOCK

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

Fox River

05/15/90

Condition Index Cutoff: 100

APPLETON FIRST LOCK (UPPER DAM)

No walls have been defined for this structure.

APPLETON FOURTH LOCK (LOWER DAM)

No walls have been defined for this structure.

APPLETON SECOND LOCK

No walls have been defined for this structure.

APPLETON THIRD LOCK (UPPER DAM)

No walls have been defined for this structure.

CEDARS LOCK

No walls have been defined for this structure.

DEPERE LOCK

No walls have been defined for this structure.

Selective Wall Condition Index Report Continued...

KAUKAUNA DAM AND GUARD LOCK

No walls have been defined for this structure.

KAUKAUNA LOCK NO. 1

No walls have been defined for this structure.

KAUKAUNA LOCK NO. 2

No walls have been defined for this structure.

KAUKAUNA LOCK NO. 3

No walls have been defined for this structure.

KAUKAUNA LOCK NO. 4

No walls have been defined for this structure.

KAUKAUNA LOCK NO. 5

No walls have been defined for this structure.

LITTLE CHUTE COMBINED LOCK

No walls have been defined for this structure.

LITTLE CHUTE FIRST (GUARD) LOCK

No walls have been defined for this structure.

Selective Wall Condition Index Report Continued...

LITTLE CHUTE SECOND LOCK

No walls have been defined for this structure.

LITTLE KAUKAUNA LOCK

No walls have been defined for this structure.

MENASHA LOCK AND DAM

No walls have been defined for this structure.

RAPIDS CROCHE LOCK

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

Illinois River

05/15/90

Condition Index Cutoff: 100

BRANDON ROAD LOCK AND DAM

No walls have been defined for this structure.

DRESDEN ISLAND LOCK AND DAM

No walls have been defined for this structure.

LA GRANGE LOCK AND DAM

No walls have been defined for this structure.

MARSEILLES LOCK

No walls have been defined for this structure.

PEORIA LOCK AND DAM

No walls have been defined for this structure.

STARVED ROCK LOCK AND DAM

No walls have been defined for this structure.

Selective Wall Condition Index Report Continued...

SELECTIVE WALL CONDITION INDEX REPORT

Inland Route

05/15/90

Condition Index Cutoff: 100

Crooked River Lock and Weir

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

Mississippi River

05/15/90

Condition Index Cutoff: 100

MISSISSIPPI RIVER LOCK AND DAM #01

Guard Wall **GW**

Total Monoliths: 4 Average Wall CI: 87 Lowest Wall CI: 60

MISSISSIPPI RIVER LOCK AND DAM #02

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #03

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #04

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #05

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #05A

No walls have been defined for this structure.

Selective Wall Condition Index Report Continued...

MISSISSIPPI RIVER LOCK AND DAM #06

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #07

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #08

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #09

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #10

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #11

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #12

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #13

No walls have been defined for this structure.

Selective Wall Condition Index Report Continued...

MISSISSIPPI RIVER LOCK AND DAM #14

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #15

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #16

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #17

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #18

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #19

Upper Guide Wall LS

Total Monoliths: 10 Average Wall CI: 97 Lowest Wall CI: 93

Main Chamber Land Wall

Total Monoliths: 42 Average Wall CI: 76 Lowest Wall CI: 50

Mississippi River

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Selective Wall Condition Index Report Continued...

Lower Guide Wall

LS

Total Monoliths: 19 Average Wall CI: 100 Lowest Wall CI: 100

Upper Guide Wall

RS

Total Monoliths: 2 Average Wall CI: 90 Lowest Wall CI: 90

Main Chamber River Wall

Total Monoliths: 40 Average Wall CI: 88 Lowest Wall CI: 65

Lower Guide Wall

RS

Total Monoliths: 11 Average Wall CI: 80 Lowest Wall CI: 70

MISSISSIPPI RIVER LOCK AND DAM #20

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #21

No walls have been defined for this structure.

MISSISSIPPI RIVER LOCK AND DAM #22

No walls have been defined for this structure.

ST. ANTHONY FALLS LOWER LOCK AND DAM

No walls have been defined for this structure.

Mississippi River

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Selective Wall Condition Index Report Continued...

ST. ANTHONY FALLS UPPER LOCK AND DAM

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

Sandy River

05/15/90

Condition Index Cutoff: 100

SANDY LAKE LOCK AND DAM

No walls have been defined for this structure.

SELECTIVE WALL CONDITION INDEX REPORT

South St. Mary's River

05/15/90

Condition Index Cutoff: 100

MACARTHUR LOCK

Guard Wall **GW**

Total Monoliths: 2 Average Wall CI: 60 Lowest Wall CI: 60

SELECTIVE WALL CONDITION INDEX REPORT

St. Mary's River

05/15/90

Condition Index Cutoff: 100

DAVIS LOCK

Guard Wall **GW**

Total Monoliths: 3 **Average Wall CI:** 60 **Lowest Wall CI:** 60

POE LOCK

No walls have been defined for this structure.

SABIN LOCK

No walls have been defined for this structure.

List Wall Descriptions

WALL DEFINITION LISTING

Mississippi River

05/15/90

MISSISSIPPI RIVER LOCK AND DAM #19

Upper Guide Wall

LS

1L:UG01	2L:UG01	3L:UG01	4L:UG01	5L:UG01
6L:UG01	7L:UG01	8L:UG01	1U:UG01	

Comment:

Upper Guide Wall Land Side

Main Chamber Land Wall

9L:LW02	10L:LW02	11L:LW02	12L:LW02	13L:LW02
14L:LW02	15L:LW02	16L:LW02	17L:LW02	18L:LW02
19L:LW02	20L:LW02	21L:LW02	22L:LW02	23L:LW02
24L:LW02	25L:LW02	26L:LW02	27L:LW02	28L:LW02
29L:LW02	30L:LW02	31L:LW02	32L:LW02	33L:LW02
34L:LW02	35L:LW02	36L:LW02	37L:LW02	38L:LW02
39L:LW02	40L:LW02	41L:LW02	42L:LW02	43L:LW02
44L:LW02	45L:LW02	46L:LW02	47L:LW02	48L:LW02
49L:LW02				

Comment: None Entered.

Lower Guide Wall

LS

50L:LG03	51L:LG03	52L:LG03	53L:LG03	54L:LG03
55L:LG03	56L:LG03	57L:LG03	58L:LG03	59L:LG03
60L:LG03	61L:LG03	62L:LG03	63L:LG03	64L:LG03
65L:LG03	66L:LG03	67L:LG03		

Comment:

Lower Guide Wall Land Side

Upper Guide Wall

RS

Wall Definition Listing Continued...

Upper Guide Wall (Continued)

RS

1R:UG04

Comment:

Upper Guide Wall River Side (One Monolith)

Main Chamber River Wall

2R:RW05	3R:RW05	4R:RW05	5R:RW05	6R:RW05
7R:RW05	8R:RW05	9R:RW05	10R:RW05	11R:RW05
12R:RW05	13R:RW05	14R:RW05	15R:RW05	16R:RW05
17R:RW05	18R:RW05	19R:RW05	20R:RW05	21R:RW05
22R:RW05	23R:RW05	24R:RW05	25R:RW05	26R:RW05
27R:RW05	28R:RW05	29R:RW05	30R:RW05	31R:RW05
32R:RW05	33R:RW05	34R:RW05	35R:RW05	36R:RW05
37R:RW05	38R:RW05	39R:RW05	40R:RW05	41R:RW05

Comment: None Entered.

Lower Guide Wall

RS

42R:LG06	43R:LG06	44R:LG06	45R:LG06	46R:LG06
47R:LG06	48R:LG06	49R:LG06	50R:LG06	51R:LG06

Comment:

Lower Guide Wall River Side

River / Structure Listing

RIVER/STRUCTURE LISTING

05/15/90

Mississippi River

NCR	MISSISSIPPI RIVER LOCK AND DAM #11
NCR	MISSISSIPPI RIVER LOCK AND DAM #12
NCR	MISSISSIPPI RIVER LOCK AND DAM #13
NCR	MISSISSIPPI RIVER LOCK AND DAM #14
NCR	MISSISSIPPI RIVER LOCK AND DAM #15
NCR	MISSISSIPPI RIVER LOCK AND DAM #16
NCR	MISSISSIPPI RIVER LOCK AND DAM #17
NCR	MISSISSIPPI RIVER LOCK AND DAM #18
NCR	MISSISSIPPI RIVER LOCK AND DAM #19
NCR	MISSISSIPPI RIVER LOCK AND DAM #20
NCR	MISSISSIPPI RIVER LOCK AND DAM #21
NCR	MISSISSIPPI RIVER LOCK AND DAM #22
NCS	MISSISSIPPI RIVER LOCK AND DAM #01
NCS	MISSISSIPPI RIVER LOCK AND DAM #02
NCS	MISSISSIPPI RIVER LOCK AND DAM #03
NCS	MISSISSIPPI RIVER LOCK AND DAM #04
NCS	MISSISSIPPI RIVER LOCK AND DAM #05
NCS	MISSISSIPPI RIVER LOCK AND DAM #05A
NCS	MISSISSIPPI RIVER LOCK AND DAM #06
NCS	MISSISSIPPI RIVER LOCK AND DAM #07
NCS	MISSISSIPPI RIVER LOCK AND DAM #08
NCS	MISSISSIPPI RIVER LOCK AND DAM #09
NCS	MISSISSIPPI RIVER LOCK AND DAM #10
NCS	ST. ANTHONY FALLS LOWER LOCK AND DAM
NCS	ST. ANTHONY FALLS UPPER LOCK AND DAM

Condition Index Scales & Zones

Table 1
Condition Index Scale

Value	Condition Description
85-100	Excellent--No noticeable defects, or wear visible
70-84	Very Good--Only minor deterioration or defects evident
55-69	Good--Some deterioration or defects evident, function not impaired
40-54	Fair--Moderate deterioration, function not seriously impaired
25-39	Poor--Serious deterioration in at least some portions of structure, function seriously impaired
10-24	Very Poor--Extensive deterioration, barely functional
0-9	Failed--General failure or failure of a major component, no longer functional

Table 2
Condition Index Zones

Zone	CI Range	Action
1	70-100	Immediate action not required
2	40-69	Economic analysis of repair alternatives recommended to determine appropriate maintenance action
3	0-39	Detailed evaluation required to determine the need for repair, rehabilitation, or reconstruction, safety evaluation recommended

Concrete Removal Methods

Table 5-1. General Classification of Concrete Removal Methods (from EM 1110-2-2002).

Category	Description	Specific Methods
Blasting	Blasting methods generally employ rapidly expanding gas confined within a series of boreholes to produce controlled fracture and removal of concrete.	Explosive blasting High-pressure carbon dioxide blaster*
Cutting	Cutting methods generally employ mechanical sawing, intense heat, or high-pressure water jets to cut around the perimeter of concrete sections to allow removal.	Diamond saw Rotary head cutter Thermal lance High-pressure water jet
Impacting	Impacting methods generally employ the repeated striking of a concrete surface with a mass to fracture and spall the concrete.	Hand-held breaker Vehicle mounted breaker
Presplitting	Presplitting methods generally employ mechanical wedge devices, water pressure pulses, or expansive chemicals used in boreholes drilled at points along a predetermined line to induce a crack plane to allow for removal of concrete.	Hydraulic splitters Water pressure pulse devices Expansive agents
Spalling	Spalling methods generally employ mechanical devices that develop tensile stresses large enough to remove pieces of concrete from a larger mass.	Concrete spaller Hydraulic rock-breaker

* Method is not commercially available.

Table 5-2. Summary of Advantages and Disadvantages for Concrete Removal Methods. (Only those methods that are known to be commercially available are included in this table from EM 1110-2-2002.)

Category	Method	Advantages	Disadvantages
Blasting	Explosive blasting	(1) Most expedient and economical method for removing large volumes of concrete. (2) Produces good fragmentation of concrete debris for removal.	(1) Requires highly skilled personnel for design and execution of blasting projects. (2) Stringent safety regulations must be imposed in handling and usage of explosives.

(Continued)

(Sheet 1 of 4)

Table 5-2. (Continued)

Category	Method	Advantages	Disadvantages
Blasting	Explosive blasting		<ul style="list-style-type: none"> (3) Produces high levels of noise, ground vibration, gas fumes, and fly rock. (4) Requires special control techniques to limit damage to concrete that remains.
	High-pressure carbon dioxide blaster	<ul style="list-style-type: none"> (1) Less violent breaking action occurs than with explosive blasting, thereby resulting in less noise, ground vibration, fly rock, and damage to concrete that remains. (2) No crushing of concrete occurs around boreholes. (3) Produces no toxic fumes (non-inflammable carbon dioxide gas is released). (4) Fewer safety requirements than those for explosive blasting (5) Cartridges are reusable. 	<ul style="list-style-type: none"> (1) Requires highly skilled personnel for design and execution of blasting projects. (2) High initial cost. (3) High drilling cost for deep concrete removals. (4) A retaining weight must be placed over the boreholes as an added precaution against expulsion of the cartridge. (5) Refilling of cartridge requires an air-conditioned environment in hot climates.
Cutting	Diamond saw	<ul style="list-style-type: none"> (1) Precision cuts with minimal vibration and damage to concrete that remains. (2) Relatively large sections can be removed at one time. (3) No dust is produced. (4) Relatively safe operation. 	<ul style="list-style-type: none"> (1) Cutting operation is slow and costly. (2) Limited cutting depth. (3) Cutting reinforced concrete increases blade wear and hence operation costs.
	Rotary head cutter	<ul style="list-style-type: none"> (1) Effective means of cutting deteriorated concrete. (2) Well-defined limits of concrete removal. (3) Relatively small and easily handled concrete debris. (4) Simplicity of operation. 	<ul style="list-style-type: none"> (1) Large electric power demand. (2) Limited mobility. (3) Dust problem.
	Powder torch thermal lance, and powder lance	<ul style="list-style-type: none"> (1) Effective means of cutting reinforced concrete. (2) Irregular shapes can be cut. (3) Produce minimal noise, vibration, and dust. 	<ul style="list-style-type: none"> (1) Cutting operation is slow and costly. (2) Not suitable for cuts where slag flow is restricted. (3) Produce smoke and fumes. (4) The extent of damages to concrete that remains is unknown.

(Continued)

(Sheet 2 of 4)

Table 5-2. (Continued)

Category	Method	Advantages	Disadvantages
Cutting	Powder torch, thermal lance, and powder lance		(5) Fire hazard, and operator must be protected against possible burns.
	High-pressure water jet	(1) Produces minimal damage to the concrete that remains. (2) Irregular shapes can be cut. (3) Produces no heat, vibration, or dust. (4) Can cut concrete underwater with little loss of efficiency. (5) The reinforcement within the removal area can be preserved for reuse. (6) Applicable for removing large areas of deteriorated concrete.	(1) The cutting operation is slow and costly. (2) High initial involvement. (3) Cannot cut reinforcing steel or extremely abrasion-resistant aggregate. (4) Additional safety require- ments and procedures are required due to high pressure of systems.
Impacting	Hand-held breaker	(1) Low initial cost. (2) Can be operated by un-skilled labor. (3) Can be used in areas of limited work space. (4) Readily available commer- cially.	(1) Slow removal rate. (2) Limited to downward break- ing action. (3) Produces noise, vibration, and dust.
	Vehicle-mounted breaker	(1) Efficient tool for removing large volumes of concrete. (2) Efficient tool for removing concrete from wall surfaces. (3) Readily available commer- cially.	(1) High cyclic energy applied to a structure may have an adverse effect on the integrity of the structure. (2) Produces high level of noise and dust. (3) Concrete that remains may be damaged.
Presplitting	Hydraulic splitter	(1) Can be used to presplit and separate large sections of concrete for removal. (2) Can be used on wall surfaces and in areas of limited work space. (3) Limited skills are required by the operator. (4) Produces no vibration, fly rock, or dust.	(1) Limited control on crack plane depth. (2) For reinforced concrete structures, other means are required to cut reinforcing steel. (3) Secondary means of breakage are often required to sep- arate and break sections to increase efficiency in handling and removal work.

(Continued)

(Sheet 3 of 4)

Table 5-2. (Continued)

Category	Method	Advantages	Disadvantages
Presplitting	Expansive agents	<ul style="list-style-type: none"> (1) Reasonably safe operation. (2) Can be used to remove large volumes of concrete and are best suited for use in vertical holes of significant depth. (3) Limited skills are required by field personnel. (4) Produce no vibration, fly rock, or dust. 	<ul style="list-style-type: none"> (1) The agents are expensive and the overall operation is costly when drilling and secondary removal expenses are included. (2) Limited control on crack plane depth. (3) The agents may not be effective if allowed to freeze or overheat. (4) Secondary means are required to complete separation and removal of the concrete. (5) May require several days before presplitting becomes optimum.
	Water pressure pulse devices	<ul style="list-style-type: none"> (1) The devices are economical, portable, rugged, and are easy to use and maintain. (2) The devices have self-contained power sources. (3) Vibration generated is negligible. (4) Devices are unaffected by temperature extremes. 	<ul style="list-style-type: none"> (1) The devices require bore-holes at close intervals to control crack propagation. (2) Control of crack plane depth is limited. (3) The devices are not applicable for use on vertical surfaces such as lock walls. (4) The devices produce some noise.

(Sheet 4 of 4)

Appendix B

Condition Index Calculation Form

LOCK MONOLITH CONDITION INDEX CALCULATION FORM

Lock: _____ Monolith #: _____

Date: _____ Inspector: _____ Gate Block? yes no

Alignment Problems?: _____

DISTRESS CATEGORIES:	DIVISION A: All Blocks				DIVISION B: Gate Block				
	Deduct Values $<=.01" <=.04" <=.08" >.08$				Additional Deducts $<=.01" <=.04" <=.08" >.08$				
CRACKING	10	20	30	40	5	10	15	20	
	24 Horizontal	10	20	30	40	-	10	20	30
	25 Vert & Transverse	10	30	50	70	-	-	-	-
	26 Vert & Longitudinal	20	40	60	80	-	-	-	-
	27 Diagonal	10	20	40	60	-	-	-	-
	28 Random	10	20	30	40	5	10	15	20
	29 Longit Floor								
VOLUMETRIC CRACKING	%Width	%Depth	Deduct		Additional Deduct				
	21 Checking	100	10	50					
	22 D-Cracking	100	6	30					
	23 Pattern	100	2	10					
	VOLUME LOSS	50	10	25					
	31 Abrasion	50	6	15					
	33 Honeycomb	50	2	5					
STEEL	20	10	10						
	34 Pop-outs	20	6	6					
	35 Scaling	20	2	2					
	36 Spalling								
	37 Disintegration								
	Deduct = $(\%W) * (\%D) / 20$								
	42 Reinforcing (exposed)	Any Area	> 50% Area						
43 Prestress (corrosion)	30	60							
CONDUITS	60								
	31 Abrasion	$\leq 3"$	$\leq 6"$	$> 6"$					
	32 Cavitation	10	20	30					
	36 Spalled Joint	20	40	60					
	41 Corrosion Stains								
	44 Damaged Armor								
	LEAKAGE & DEPOSITS								
51 Leakage									
52 Deposits									
OTHER									
36 Spalled Joint									
41 Corrosion Stains									
44 Damaged Armor									
LEAKAGE & DEPOSITS									
51 Leakage									
52 Deposits									
Deduct Values									
Light	Heavy								
5	10								
5	10								
5	10								
Light	Moderate	Heavy							
5	10	20							
5	10	20							
Sum Div C: _____	<20 MAX								
DIVISION C							COMPUTE DEDUCT VALUE:		
							1) Max Div. A = _____		
							2) Max Div. B = _____		
							3) Sum Div. C = _____		
							4) Sum Div. D = _____		
							TOTAL DEDUCT = _____		
							C. I. RATING = _____		

Field Inspection Form

LOCK MONOLITH FIELD INSPECTION FORM

Lock: _____ Monolith #: _____ L M R

Date: _____ Inspector: _____ Gate Block? YES NO

Location Codes

L-Land Wall	M-Intermediate Wall	R-River Wall
LS-Land Side Face	RS-River Side Face	D-Deck
		C-Conduit
		F-Floor

CRACKING

24-Horizontal	25-Vertical&Transverse	26-Vertical&Longitudinal
27-Diagonal	28-Random	29-Longitudinal Floor

1	Crack Category:	Width: (in.)	LS	RS	D	C	F
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Remarks: _____

2	Crack Category:	Width: (in.)	LS	RS	D	C	F
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Remarks: _____

3	Crack Category:	Width: (in.)	LS	RS	D	C	F
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Remarks: _____

4	Crack Category:	Width: (in.)	LS	RS	D	C	F
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Remarks: _____

VOLUME LOSS TYPE CRACKING / DETERIORATION

21-Checking	22-D-Cracking	23-Pattern	31-Abrasion	32-Cavitation
33-Honeycomb	34-Pop-Outs	35-Scaling	36-Spalling	37-Disintegration

1	Distress Category:	LS	RS	D	C	F
---	--------------------	----	----	---	---	---

Distress: width _____ depth _____ height _____ elevs. _____
 Section: width _____ depth _____ (at elevation of distress)
 Remarks: _____

2	Distress Category:	LS	RS	D	C	F
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Distress: width _____ depth _____ height _____ elevs. _____
 Section: width _____ depth _____ (at elevation of distress)
 Remarks: _____

3	Distress Category:	LS	RS	D	C	F
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Distress: width _____ depth _____ height _____ elevs. _____
 Section: width _____ depth _____ (at elevation of distress)
 Remarks: _____